This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

600025164O

18855 d 9

A HAND-BOOK

TO THE

GEOLOGY OF SHROPSHIRE.

A HAND-BOOK

OF THE

GEOLOGY OF SHROPSHIRE

BY

J. D. LA TOUCHE,

Vicar of Stokesay,

PRESIDENT OF THE CARADOC FIELD CLUB.

London:
EDWARD STANFORD, 55, CHARING CROSS.
Shrewsbury:
ADNITT & NAUNTON, BOOKSELLERS, THE SQUARE.

MDCCCLXXXIV.

18855. d. 9.

BODLEI
OXFOR

TO

WILLIAM S. SYMONDS,

RECTOR OF PENDOCK;

WHOSE ZEAL FOR SCIENCE HAS INSPIRED, WHOSE SYMPATHY HAS ENCOURAGED,
AND WHOSE EXAMPLE HAS STIMULATED
MANY A STUDENT OF NATURE:
TO WHOSE RARE POWER OF IMPARTING INSTRUCTION
THE NUMEROUS FIELD CLUBS WITH WHICH HIS NAME IS ASSOCIATED
HAVE SO OFTEN BEEN INDEBTED:
AND WHOSE PERSONAL FRIENDSHIP
HAS BEEN, AND IS,
ONE OF THE MOST VALUED POSSESSIONS OF MY LIFE,
I DEDICATE THIS BOOK.

J. D. LA TOUCHE.

Preface.

THE following work was undertaken to meet the requirements of a scheme adopted by the CARADOC NATURALISTS' FIELD CLUB in the year 1880, the object of which was to offer prizes to the pupils in Elementary Schools in Shropshire for properly arranged collections of specimens in Natural History; and the original intention was to confine its scope strictly to the limits of the county. As it progressed however, it appeared desirable, and indeed indispensable, to figure and describe many forms which occur in the adjoining counties, as well as others from a greater distance, for the sake of comparison. To attain the purpose stated above, and at the same time to produce a volume which, at a moderate cost, should be accessible to students of limited means, have been the principal objects aimed at in its composition: and if it may appear to some readers that the descriptions of the figures are in many instances somewhat meagre, they will kindly bear in mind the original intention of the volume, and that to have extended them to greater length would have increased the price beyond the amount contemplated. The most characteristic features of each fossil, as well as those which distinguish it from allied species, have been noted, and the figures have been left to tell the remainder of the story; for, as Mr. Salter well remarks, "the details of shape are better understood by a figure than by description; a circumstance not at all uncommon in natural history illustration."

The author is deeply sensible of the many deficiences which will be found in this work. Want of space has compelled him to omit, except in a few instances, explanations of scientific terms,[*] references to authors, and any general information on the elementary facts of geology.[†] Moreover, the formations which occur in Shropshire, except the Silurian, have been very inadequately treated of. It would, too, he thinks, have been better had the fossils been grouped in their natural classes, while at the same time their stratigraphical order had been preserved. But although the volume is indeed far from perfect or exhaustive, he has endeavoured to attain accuracy, and to condense as much matter as possible within the space at his command, and hopes that it may therefore be found useful, not only to local geologists, but also to the general student.

---

[*] Professor Nicholson's "Manual of Palæontology" (Blackwood) contains an excellent glossary of scientific terms and of the names of fossils, &c.

[†] Professor Geikie's "Text Book of Geology," or, for beginners, a shilling volume by the same author (Macmillan), may be recommended to those who require elementary information in the science. An unpublished volume by Mr. Etheridge, of which he generously gave the author the use, contains references to the numerous works and papers in which nearly every known fossil has been described. It may be hoped that so valuable a book, and one that must have cost great labour and research, may before long appear in print.

It will be seen that the figures in the first five plates are by a different hand to that which has drawn the succeeding ones. The fact is that the former were the work of Mr. T. D. La Touche, who, when they were completed, received an appointment on the Geological Survey of India, and was compelled to abandon the task which he had undertaken. Of the forms delineated there are a few which have never before been published. Among them are several Graptolites supplied by J. Hopkinson, Esq.; Lithodomus borings, detected in the Aymestry limestone by Professor Corfield, who has thus removed to an earlier age than had previously been known the evidence of boring bivalves; and last, not least, Pachytheca (drawn and described for this work by Sir J. Hooker), a form of extreme interest as preserving the fragile filaments of a palæozoic alga so perfectly that they are capable of being compared and even identified with similar organisms of the present day.

Except in the first two parts of the work the author cannot lay claim to much that is original: the remainder is a compilation, derived from the best books to which he has had access, and in many cases he has been largely assisted by the writers themselves. Among those to whom his special thanks are due on this account, and for a revision of portions of his work, are Mr. Etheridge, Dr. Davidson, Dr. Callaway, Professor Lapworth, and Messrs. J. Hopkinson, J. Marr, and C. Fortey. He has also received valuable help from Sir J. D. Hooker, Dr. Woodward, Professors Rupert Jones, and Corfield. He has drawn largely on the splendid monographs of Davidson, Blake, Woodward, and Ray Lankester, and on Professor Nicholson's useful Manual of Palæontology. To R. Jasper More, Esq., he is indebted for the use of the maps required for a description of the geology of the county; to the Rev. W. Elliot for the compilation of the index; and to many friends, among whom he may mention Messrs. G. Maw, G. Cocking, A. Marston, T. Salwey, E. Levy, and H. Heape, for the loan of specimens.

Stokesay, Shropshire,
November, 1884.

ERRATA.

Page 16, l. 1, insert VI. at beginning of paragraph.
Page 20, l. 29, for Penelley *read* Pennerley.
Page 22, l. 4, and Pl. i. fig. 17, for Didymograpsus *read* Didymograptus.
Page 24, l. 14, for Gomphoceras *read* Ascoceras.
,, ,, l. 23, Page 26, l. 3, Pl. xvii. fig. 556, and Pl. x. fig. 260, for Homolonotus *read* Homalonotus.
,, ,, l. 15, for accuminatus *read* acuminatus.
Page 28. l. 9, for high Vinnals *read* High Vinnals.
,, ,, l. 14, for Tittestone *read* Titterstone.
Page 30, l. 27, for Sphæospongia *read* Sphærospongia.
Page 32, 2nd line from bottom, for Cyathophylinæ *read* Cyathophyllinæ.
Page 33, l. 15, for xi. *read* ix.
Page 35, l. 1. for Euclayptocrinus *read* Eucalyptocrinus.
Page 40, l. 19, for Sphrærexochus, and Pl. x. fig. 254, for Sphærexocus *read* Sphærexochus.
Page 42, l, 23, for Ptylodictya *read* Ptilodictya.
Page 45, 11, lines from bottom, for Englypha *read* Euglypha.
Page 53, l, 31, for Crosspterygidæ *read* Crossopterygidæ
Page 56, fig 24, for Rodenia *read* Redonia.
Page 67, fig. 268, for Squammata *read* Squamata.
Page 76, fig. 553, for Squammosum and Pl. xvii. fig. 553, for Squammosa *read* Squamosum.
Plate vi fig. 140, for trapezoidalis *read* plicatellus.
Plate vii fig. 152, for Connularia *read* Conularia.
Plate xiii. fig. 451, for Siphontreta *read* Siphonotreta.
Plate xvi. fig. 530, for Ophidoceras *read* Ophidioceras.
Plate xvii. fig. 564, for Ceratiocharis *read* Ceratiocaris.
Plate xx. fig 682, for Pteaspis *read* Pteraspis.
,, ,, fig. 710, for Lithostration *read* Lithostrotion.
Plate xxii. fig. 793, for vespertilio *read* elegantula.

contents. The value of the latter, however important, is manifestly subordinate to that of the former; since, although various strata are undoubtedly characterised by certain organisms, we are precluded by our ignorance as to the duration in time of particular types from drawing any absolute or positive conclusion from this branch of evidence—we cannot rise above a greater or less probability: whereas the ascertained superposition of strata obviously affords certain information as to their succession.

Part 1.

THE object of the present work is chiefly to assist the researches of those who desire to study the Geological formations which are represented in the County of Salop. To this end, a general description will first be given of the areas occupied by these strata. This will be followed by such information as will enable observers to reach most easily the best localities for obtaining Fossils and studying the sections which exhibit the Physical Geology of each district. In the third part an account, necessarily very brief, will be given of the principal characteristics by which the Fossils, usually found in this and the adjoining counties, may be distinguished from each other. It is hoped that this, combined with the Plates which follow, will enable collectors to identify and name most of their specimens. The figures in these Plates have, in many instances been drawn from original sources, but free use has at the same time been made of many works which from their expense or rarity are not generally accessible.

Our limits will not allow of any extended discussion of the reasons which have determined the sequence or correlation of these rocks. The reader is referred for these, as well as for information on the general principles of Geology, to the numerous works and papers which have been published on these subjects.

One remark, however, may be made which it will be useful for the young observer to bear in mind; the use of his compass and clinometer, in his geological excursions, is of quite as great importance as that of his hammer. The determination of the succession of strata depends for the most part on two kinds of evidence: 1st, Their relative position, which is ascertained by their dip and strike; and, 2nd, Their Fossil contents. The value of the latter, however important, is manifestly subordinate to that of the former; since, although various strata are undoubtedly characterised by certain organisms, we are precluded by our ignorance as to the duration in time of particular types from drawing any absolute or positive conclusion from this branch of evidence—we cannot rise above a greater or less probability: whereas the ascertained superposition of strata obviously affords certain information as to their succession.

The following Geological formations are represented within the limits of Shropshire:—

I. PRE-CAMBRIAN.
II. CAMBRIAN.
III. LOWER SILURIAN (or Ordovician).
IV. LLANDOVERY.
V. UPPER SILURIAN.
VI. TRANSITION
VII. OLD RED SANDSTONE.
VIII. CARBONIFEROUS.
IX. PERMIAN.
X. TRIASSIC.
XI. LIAS.

I. The first of the above series, viz: the Pre-cambrian, has only recently been detected and described by Dr. Callaway. That careful observer has shown that in many places rocks which had been supposed by Sir R. Murchison and the Geological surveyors to be eruptive or altered Silurian, and accordingly coloured red in the maps, are stratified, underlie the Cambrian, and have frequently furnished the materials of which the latter are composed. In the papers which Dr. Callaway has published on this subject (Quarterly Journal, Geological Society, vol. xxxv, p. 643. *Ibid*, vol. xxxvi, p. 536. *Ibid*, vol. xxxviii, p. 119.), he has given reason to believe that these archaic rocks represent at least two formations, viz: The Lewisian of the N. Highlands, or the Laurentian of Canada, and the Pebidian of Anglesea, Charnwood Forest and St. David's. It will not be possible in the present work to describe these rocks in greater detail. The localities where they may be studied are as follows:—Lilleshall Hill, the series near Wellington, of the Ercall, Lawrence Hill, the Wrekin and Primrose Hill, Wrockwardine; and further south the Lawley, Caer Caradoc, Cardington, Hope Bowdler, Hazlar and Helmeth, Ragleth and Wartle Knoll, and a chain of exposures extending from Pontesbury to Linley Hall, intervening between the Cambrian of the Longmynd to the E. and the Stiperstone ridge to the W., described by Sir R. Murchison as Lingula Flags, but which has been shown by Dr. Callaway to be the equivalents of the Shineton Shales and the Tremadoc series.

II. The Lower Cambrian Rocks constitute the Longmynd range of hills, which form so conspicuous a feature in the scenery of the centre of the county. Commencing at the southern extremity between Horderley and Plowden stations on the Bishop's Castle Railway line, they are found to be flanked by a conglomerate belonging to the May Hill or upper Llandovery rocks; which, unconformably deposited on their highly inclined edges, may be traced to near Church Stretton on the east, and to near Mindtown on the west flanks of the ridge. Proceeding from Linley towards the N.N.E. the formation is found to be bounded by the Precambrian rocks before mentioned, and further north, to be flanked by the Coal Measures and Permian strata. Near Shrewsbury it narrows to a point, but further N.E. a patch of it forms Haughmond Hill. The thickness of this stratum is very great and has been estimated at 10,000 feet. The upper portions consist of thick beds of conglomerate, which may be examined near Plowden station on the western slopes opposite Mindtown, and at Sharpstones Hill, near Shrewsbury. Its greatest superficial breadth is about 5 miles. The only organic remains are worm tracks, *(Arenicola didyma)* associated with the depressions made by rain drops in the sand of the ancient sea beach; these may be collected in the Ashes Valley which penetrates the hills near Little Stretton. Close to this latter place there is also a good exposure of the Upper Llandovery resting unconformably on the Cambrian.

The very high angle at which these rocks are inclined, and the relative position of the newer strata that clothe their sides, are facts only consistent with the supposition that the Longmynd was a range of hills standing out of the primæval sea, in which the sedimentary deposits of the Llandovery and Wenlock strata were being thrown down. Between the formation of these Cambrian strata and the Llandovery, an immense period of time must have intervened, represented in this neighbourhood by the vast series of the Lower Silurian rocks. Another still greater hiatus in the record may be observed at the northern extremity of the area; where, as has been said, the Coal Measures and Permian abut on the Cambrian, omitting the whole of the Silurian and Devonian strata, which within a few miles were being formed while these were dry land.

III. It has already been stated that the remarkable ridge consisting of shales and quartzites, called the Stiperstones, was by Sir R. Murchison, correlated with the Lingula flags of Wales, a member of the upper Cambrian strata. Dr. Callaway has, however, given reason to believe that the Stiperstone ridge is properly the base of the Arenig series, the lowest member of the Lower Silurian; that the shales which are found in the valley between the Longmynd and the Stiperstones are identical with those at Shineton, Pedwardine, and Malvern; and that all of these are the equivalents of the Tremadoc or uppermost member of the Cambrian. Exposures of these shales, containing fossils, may here be found below Gittens Hay, and on the hill west of Habberley. At Shineton, about a mile from Cressage station, in the steep bank of the brook, there is a good exposure where abundance of fossils may be collected, but in the dingle near Garmston and Eaton Constantine the thickness of the beds is better seen. Other good localities are Dryton, Bull Hill Cottage near Evenwood, and the ravine between the Lawley and Hoar Edge. This remarkable formation appears again at Pedwardine, a farm about three miles from Bucknell station, where it is exposed in the side of the high road and in a steep lane running up to some farm buildings. In these latter shales, the *Dictyonema Sociale* and a small *Lingulella* are abundant. It is remarkable that both here and at Shineton the beds, which are inclined at a high angle, are capped at a very low one by the May Hill Sandstone, the vast thickness of the Lower Silurian strata being unrepresented. In a quarry near this place, in Brampton Brian Park, may also be seen an exposure of Cambrian Grit, coloured as Upper Llandovery by the Geological Survey.

The Lower Silurian strata consist of the following members:—

(a.) ARENIG. *(b.)* LLANDEILO. *(c.)* CARADOC OR BALA.

(a.) The Stiperstones, a line of hills extending from Pontesbury to Linley, a distance of about ten miles, constitutes the lowest portion of the Arenig group. At intervals along the ridge gigantic masses of quartzite rock project from the surface, and the slopes of the hill are covered with the blocks which have through long ages been detached from them by atmospheric action. The upper portions of the Arenig can be examined and many fossils obtained at Ritton Castle, Shelve Church, Bog Mine, White Grit Mine, and Disgwylfa, about five miles from Lydham Station on the Bishop's Castle Railway.

(b.) The Llandeilo formation occurs in regular succession with the foregoing and inclined at the same angle, extending as far as Chirbury to the west, to near Worthen on the north, and Churchstoke to the south. It is fringed all along its western border by the Wenlock shale, and in some places by the Upper Llandovery, the intervening Bala beds being here omitted. This fact may have been the result of one of two causes. (1.) It is possible that the Bala may have been deposited in regular succession over the whole area and subsequently, on its elevation, denuded and then the newer strata deposited; or (2) the whole may have been elevated above the sea level, and on its depression at the end of this era, the Llandovery or Wenlock deposited on its flanks. The Llandeilo rocks are also found in the neighbourhood of the Breidden Hills, where they have been, as well as near Chirbury, pierced by volcanic rocks and interbedded with felspathic ash.

(c.) Though absent to the west of the Longmynd axis, the Caradoc or Bala formation is largely developed to the east of that range of hills. There can be no doubt, however, that it was being deposited during the time intervening between the formation of the upper Llandeilo and the Llandovery, since the sequence has been clearly ascertained in other localities.

It may be arranged as follows, commencing with the lower strata:—

(1.) HOAR EDGE GRITS.
(2.) HARNAGE SHALES.
(3.) CHATWALL OR HORDERLEY SANDSTONE.
(4.) CHENEY LONGVILLE FLAGS.
(5.) ONNY SHALES.

(1.) Commencing at the southern extremity of the area, a good exposure of the Hoar Edge Grits occurs at Corston, a farm situated at a short distance from Broome

Station on the Central Wales Railway, in a road leading towards Clunbury Hill. They are here found in contact, by fault, with the upper Ludlow rock and the Pre-Cambrian, S.W. of Wartle Knoll. Further north they again appear along a ridge commencing at Carwood by Horderley, where they dip at a high angle, and at Broken-Stones, a portion of a much faulted area lying on the road from Horderley to Marsh Brook. They are also seen along the Hoar Edge and Frodesley, a range of hills running parallel with and to the east of the Caradoc and Lawley range, and as far north as Acton Burnel and Evenwood.

(2.) Exposures of the Harnage Shales, where they are found to overlie the above grits, may be found at Broomcroft, near the Devil's Causeway under Chatwall, and in the valley intervening between Hoar Edge and Enchmarsh. They are well exposed near Harnage and in the banks of Cound Brook, at which latter place, however, Dr. Callaway observes that there is a remarkable instance of inversion, the Shales at a high angle being overlain by the grits at a low one.

(3.) The Horderley Sandstone is a well marked deposit, consisting of thick bedded olive and purple Sandstones, with calcareous seams full of fossils. It constitutes a second ridge, Chatwall and Enchmarsh, parallel with that of Caradoc and Lawley. Extensive quarries at Soudley, Horderley, and Long Lane near Craven Arms, afford ample means of studying it; it is also well exposed in the railway cuttings near Marshbrook.

The above series are first found at the northern extremity of the Caradoc area, about a mile west of Harley, where they come in between the Shineton (Tremadoc) Shales and the May Hill Sandstone. Their thickness here is inconsiderable, but it rapidly increases towards the south-west.

(4.) The Cheney Longville Flags may be observed in a lane west of that village, where they are seen to overlie the preceding. They are also exposed at Woolston, Whittingslow, Acton Scott, Marshbrook and Hatton.

(5.) The Onny Shales are well exposed in the bed and on the banks of the Onny, near Cheney Longville, about 1½ miles from Craven Arms station.

IV. The Llandovery formation consists of two members, an upper and a lower. Of these only the latter is represented in Shropshire. It is classed by Sir R. Murchison as a transition stratum between the Upper and the Lower Silurians; both because most of its fossils are of a peculiar type, and that, from its relation to the rocks on which it was deposited, it would appear to have been formed after considerable changes of level had taken place. A glance at a geologically coloured map of Shropshire shows that the lines of the Llandovery formation follow in most cases the contour of the higher ground. Moreover, the lower beds in general consist of a coarse conglomerate passing up into a shelly Limestone. Such conglomerates are certain indications of a former beach. On many parts of our coast in the present day similar deposits may be observed in the act of formation. Therefore, where they occur we are afforded a clue to the configuration of the land at the time they were deposited. Accordingly we cannot be far wrong in concluding that "at the close of the Lower Llandovery epoch the S. Shropshire area was occupied by an Archipelago in which the principal islands were the Stiperstones, the Longmynd, the Wrekin, and Caer Caradoc chain, and the ridges of Hoar Edge and Chatwall,"* and that the conglomerates were deposited upon the flanks of these islands, and derived in a great measure from the materials of which their rocks are composed. A striking instance of this fact may be observed at the southern extremity of the Longmynd where the purple shales of the Lower Wenlock, which overlies the Llandovery, have evidently derived their colour from the denudation of the Longmynd schists against which they abut.

The Llandovery or May Hill conglomerate, in some places accompanied by the Limestone just spoken of, in others, where the latter is absent, may be examined all along the eastern flank of the Longmynd from Plowden to a little south of Church Stretton, where it dips at a comparatively low angle towards the east, away from the highly inclined Cambrian strata which dip towards the west; again the same may be traced on the western flank as far as Mindtown. It reappears in the form of a fossiliferous limestone and widens out until, in the neighbourhood of Norbury and Linley, it assumes a thickness of several feet and consists of an enormous mass of fossils, chiefly *Pentamerus Oblongus*, and *Petraia sub-duplicata*, *&c.* A patch of the same deposit exists near the Bog Mine to the west of the Stiperstones, and, along the northern edges of the tracts occupied by the Llandeilo and Arenig formations, it is displayed in an undulating line. Some twenty miles to the east of this district the conglomerate reappears, resting nearly horizontally on the highly inclined edges of the Shineton (Tremadoc) Shales near the Wrekin, and towards the S.W., covers a considerable area, flanking the Precambrian rocks already described; though further south it again thins out to a mere shelly band, and at the instructive section in the banks of the Onny, where the upper Caradoc Shales are brought into close connection with the Purple beds of the Wenlock, it is represented only by a few nodules. Lastly, it is again found close to Pedwardine, where it also lies unconformably on the Shineton Shales.

V. The members of the Upper Silurian rocks at which we have now arrived consist of—

(a.) THE WENLOCK SHALE.
(b.) WENLOCK LIMESTONE.
(c.) LOWER LUDLOW.
(d.) AYMESTRY LIMESTONE.
(e.) UPPER LUDLOW.

---

* Dr. Callaway, Sketch of the Geology of Shropshire.

(a.) The Wenlock Shale, capped by a bed of limestone, constitutes the fine escarpment known as Wenlock Edge which stretches in a S.W. direction from the town of Wenlock in nearly a straight line for some twenty miles. To the N.E. of this place it is well displayed in Benthal Edge, and continues to Coalbrookdale, to the east of which it is faulted against the Coal Measures, while all along its western margin it rests conformably on the Upper Llandovery. The southern extremity is prolonged over the borders of the county into the remarkable valley of denudation about Burrington and Wigmore, where an admirable example of this sequence of rocks may be studied. Towards the west it is again found, overlying the Llandovery Sandstone, extending from Little Stretton as far as Edgton, and stretches away in a broad band in the direction of Wales, where it lies unconformably on rocks of the Llandeilo age.

(b.) It is succeeded along the crest of the escarpment by a stratum of Limestone abounding in corals and other fossils, but which, though of great thickness near Wenlock, gradually thins out, until about Craven Arms it is represented by a seam of nodules: though, again increasing in thickness, it re-appears round the eastern margin of the Wigmore Valley. It is remarkable that all traces of this Limestone vanish to the west, and that, therefore, the line of demarcation which it furnishes with the next member of the Upper Silurian group is here deficient.

(c.) Separated along the Wenlock Edge from the underlying Shale by the Limestone just described, the Lower Ludlow comes next in succession. Its texture is slightly more sandy than the former. It forms the face of an escarpment parallel with Wenlock Edge. A valley intervenes, which has been worn through its lower portions by denudation. Towards the southern extremity of this range it extends from the base to the summit of Norton Camp and Weo Edge, hills which flank the picturesque valley of the Onny near Stokesay Castle. It will then be found trending to the west, and may be traced to Leintwardine, whence by Downton Castle it again bends to the east towards Ludlow, whence it stretches to the S.W.. In the above district it is for the most part well distinguished from the succeeding stratum by

(d.) The Aymestry Limestone, a well marked band of some 20 feet thick about Craven Arms, Ludlow, Downton, and Aymestry, but which towards the north gradually thins out into a few shelly courses, and towards the west disappears altogether.

(e.) The Upper Ludlow is, generally, a more arenaceous deposit than the Lower; and often in its upper portions becomes even micaceous. It is in many places also well marked off from the former by the Aymestry Limestone, though towards the west, in the tract of country between Brampton Brian and Clun, and again to the north of Worthen this is absent altogether.

In some localities the summit of the Upper Ludlow rock is marked by a very interesting deposit, viz:—The Bone Bed. This is found at Linley near Bridgnorth, at Norton, Ludlow, and at Downton Castle, as well as at Malvern and other localities. It consists of a vast quantity of fragments of fish defences, shagreen, and portions of *Pteraspis*, together with the jaw bones and teeth of fishes. No complete specimens, however, of the animals to which these remains belonged have as yet been discovered in these strata, though it is evident that vast numbers of them must have lived before and at the time when this deposit was formed. We have therefore in this a notable illustration of Mr. Darwin's remark that the absence of certain links in the chain of past life is no valid reason against their actual existence at particular epochs: since, but for the discovery of this bone bed, we should have remained in ignorance that the vertebrata date so far back in time.

In connection with this subject it may here be mentioned that a specimen of Pteraspis, a species of fish allied to the Sturgeon, has been detected at Leintwardine in the Lower Ludlow rock.

The Bone Bed, in all the localities where it occurs, is succeeded by a considerable stratum of yellow sandstone, which has been named "Downton," from the place near Ludlow where it is chiefly developed; and this, in many places (the lane leading from Onibury to Norton, at Ludlow by the Railway Bridge, at the Tin Mills between Oakly Park and Downton Castle), by micaceous Shales, which, from their stratigraphical position as well as from the character of the organic remains with which they are charged, are named the Transition or Passage beds. Several new forms of crustaceans appear in these, and here are first found in any abundance the remains of cartillaginous fishes.

VII. The old Red Sandstone covers a considerable area of Shropshire, although it is more extensively developed in Herefordshire. Commencing at Ludlow we find a great expanse of this deposit following the line of the upper Ludlow rock to the S.W., and stretching to the N.E. as far as Willey and Linley near Bridgnorth. At many places in this area it is traversed by courses of calcareous rock called cornstones, and generally in these are found the few organic remains which it contains. Along its eastern margin it is bounded by the coal measures, the intermediate strata which exist elsewhere being absent. Rising out of this great tract, and upheaved by the volcanic forces of which the basalt at their summit is an evidence, are the Clee Hills, chiefly composed of the newer formation of Mountain Limestone, Millstone Grit, and the Coal Measures. Another tract where the relations of the old Red to the underlying Upper Silurian rocks may be studied, is that of Clun Forest and its outliers, while the beds of junction with the overlying Carboniferous or Mountain Limestone are seen best at Farlow, although much dislocated by volcanic action.

In this rather inaccessible district to the north of the Clee Hills have been found certain yellow sandstone strata, which, from their fossil contents and position are believed to be the equivalents of those of Dura Den in Fifeshire.

VIII. The Carboniferous Limestone and Millstone Grit are seen in their relative position to the west of Oswestry. They constitute the southern extremity of a tract which extends northwards into Denbighshire, and they are largely developed to the west of Wrexham and Ruabon. The same two formations appear to the south of Wellington and east of the Wrekin, and patches of Millstone Grit are scattered over the district round Coalbrookdale and as far north as Barrow, where it disappears. Both again are developed north and south of the Titterstone Clee Hill, but are absent in the Brown Clee.

IX. The Coal Measures are extensively displayed in the east of the county in the Forest of Wyre, extending from Abberley to Billingsley, whence, a little to the south of Broseley, the area narrows considerably, but it expands largely into the Coalfield of Coalbrookdale and Dawley, and ends in a point to the N.E. of Lilleshall. The Coal Measures of both the Clee Hills belong to the above formation, but are isolated by the effects of denudation which has left them like islands in the midst of the area of old Red Sandstone. The great Ruabon Coalfield extends south to the S.W. of Oswestry. Another stretches from a point on the Severn between Criggion and Alberbury, to the south and east of Shrewsbury, and a portion of the same extends to Leebotwood on the Shrewsbury and Hereford Railway.

The above Coalfields except that of the Clee Hills are found to underlie

X. The Permian or Lower New Red Sandstone. This stratum is developed at intervals, and sometimes largely, along the eastern margin of the Coalfield extending from the Wyre Forest to that about Coalbrookdale, also along the northern border of that which lies to the south of Shrewsbury, and a large patch along the north-eastern border of that about Leebotwood. It also bounds the Oswestry Coalfield to the east. It rests unconformably on the Coal Measures, and is also succeeded unconformably by

XI. The Upper New Red Sandstone or Triassic system. This, as its name denotes, consists of three members, the lower of which is the equivalent of the Bunter of Germany, and the upper of the Keuper. The middle, or Muschelkalk, is not represented in England. These strata are classed by Sir C. Lyell as the base of the Secondary Rocks, the Permian being the summit of the Primary or Palœozoic. They occupy the greater part of North Shropshire, and are still more fully developed in Cheshire. They consist of red sandstones, conglomerates and marls, and are for the most part destitute of fossil remains, which have probably been obliterated by the action, not accounted for, of the oxide of iron which imparts to them their colour.

Fossils, where they have been found, occur in grey and, usually, calcareous beds. Such is the case at Grinshill, north of Shrewsbury, where remarkable specimens of Rhynchosaurus, a form which seems to combine the characteristics of the Saurian and the bird, have been found; ripple marks are also abundant.

XII. A small area of the lower and middle Lias is found north of the county, but its junction with the underlying Trias is much obscured by drift.

◆

Part 2.

HAVING now given a cursory sketch of the Geological formations which may be studied within the county, we shall proceed to indicate a few routes by which they are accessible, and some of the localities where fossils chiefly abound.

I. The neighbourhood of Shineton may be conveniently reached from the Cressage station on the Severn Valley Railway. Proceeding along the road to the east, we arrive, at the distance of about a mile, at a bridge crossing a small stream. Leaving the road, walk up the left bank, and soon the section of Tremadoc Shales is reached where most of the Shineton fossils have been found. Nearly horizontal beds of Upper Llandovery strata are exposed in the brook a little higher up.

II. In the district around Wenlock and Ironbridge will be found many excellent sections of the Upper Silurian strata. "The Wenlock Shales are exposed in a deep road-cutting near the Railway Bridge, and in Farley Dingle. There is also a fine natural exposure 2½ miles to the east, by the side of a small stream flowing down the east end of Benthall Edge opposite Ironbridge, and most of the adjacent cutting on the Severn Valley Railway passes through the base of the Nodular Limestones and Shales." Mr. Maw, from whose interesting paper in the Palæontographical Society for 1882 the foregoing extract has been made, estimates the thickness of the Wenlock strata as generally from 2,800 to 2,500ft. and divides them as follows : *(a)* Wenlock Limestone about 90ft., *(b)* intermediate zone of concretionary Shale, "Tickwood beds," 300 to 500ft., *(c)* comparatively unfossiliferous soft shales from 1,800 to 1,900ft. He has, however, detected in this last a remarkably rich zone at about one-third of their thickness from the base, which he supposes to be the equivalent of the Woolhope Limestone in Herefordshire. This may be examined on the east bank of the river Severn, a short distance above Buildwas Bridge in a section of about 70 or 80ft. It is also exposed to the west in the banks of the brook south of Harley. Mr. Maw has also detected, in the lowest beds of the Wenlock in the railway cutting below Buildwas Park, the Purple Shales, which are also found on the flanks of the Longmynd, near Plowden station on the Bishop's Castle railway, and on the banks of the Onny near Longville.

The upper Ludlow beds may also be examined at Burton, near Wenlock, and the Lower, in the cuttings of the Wenlock Railway between Wenlock and Presthope. The Aymestry Limestone, which, near Stokesay attains a thickness of some 30ft. is here represented by a few calcareous courses. It may be examined in the road cutting below the Dunge House, near Broseley, and to the west of the Marsh Farm, between Broseley and Much Wenlock.

The Transition beds between the upper Ludlow and old Red Sandstone are well exposed in the banks of a little stream known as Linley Brook, two or three miles south of Broseley, and have yielded fish remains and Lingulæ, &c.

III. Taking his departure from Minsterley station the student should make for White Grit Lead Mines, and will find in the road leading to the top of the Stiperstones exposures of the Arenig rocks, occasionally containing fossil remains. At the summit the huge masses of quartzose rock standing up like weird castles from the mountain heath cannot fail to attract his attention. By careful examination of these he may obtain specimens of worm burrows piercing the rocks in a direction perpendicularly to their highly inclined surface, and if he is fortunate, may find some of them exhibiting a U shape, and terminating in two apertures at the surface, one of which is supposed to represent the entrance, and the other, the exit of the worm from the sand. The Lobworm of our sea shores forms burrows similar to these. Along the crest of the ridges many holes will be found, scraped by the sheep for shelter, and exposing the rock below. These will well repay a search, and many interesting forms have been here found in them. They especially abound at the head of the deep combs, Mytton Dingle, Perkins Beach, &c., which intersect the hills. If his object be to investigate the Pre-Cambrian strata described by Dr. Callaway, he will have to descend into the valley which separates this ridge from that of the Longmynd, and, proceeding in a south-westerly direction, will find the exposures already alluded to. The best sections of the Archæan, lying N. and E. of Pontesford Hill, are most conveniently reached from Pontesbury station, or, to examine the Arenig formation, the student may descend the western flank and make for the Penelly and White Grit Mines, where in the spoil heaps of shale he will probably find several characteristic fossils. Pursuing the road by the Bog Mine, and examining in his way the exposure of Mayhill Sandstone, and that of Arenig Shale at Ritton Castle, he will then make his way to the western gate of Linley Hall, shortly before arriving at which, he will find a good exposure of the Felspathic Ash-beds interstratified with dark coloured Shales abounding in some rare species. It was here that the *Æglina Mirabilis*, figured in our plates, was found, as well as a specimen of *Cheirurus Sedgwickii* and other interesting forms.

The Felspathic strata just alluded to, which are exposed at various spots in this district, are of high interest, and their relation to the mass of Corndon, which was probably the centre of the volcanic action to which they owe their origin, should be observed. Proceeding along the Linley drive other exposures of Arenig rocks will be found especially among the plantations near the house, where shafts, now unworked, have been driven into the rocks. Near this point, in the side of a road descending from the Rock Houses on the Stiperstones, the Shineton (Tremadoc) Shales may be detected, but they are here unfossiliferous. From Linley the observer may now proceed to the village of Norbury, close to which he will find excellent exposures of Mayhill Sandstone abounding in the characteristic fossils, and from thence he can take the train at Lydham Heath.

IV. Another excursion from Minsterley may be made to investigate the Llandeilo beds of the district. In this case the road should be taken to Hope, a picturesque valley in the sides of which exposures of Llandovery and Wenlock Shale will be found. At the head of this valley is the Roman Gravels Lead Mine. In one of the shafts of this was found some time ago a large ingot of lead stamped with the words "HADRIANUS IMP." Hence the road across country should be taken to Meadowtown, in the neighbourhood of which good specimens of *Asaphus Tyrannus* and of *Ogygia Caractici* may be obtained in the Llandeilo Shale; then by Rorrington to Chirbury, near which, at Whittree, is a large quarry displaying an extensive surface beautifully marked with ripples, and many specimens may be obtained; thence by Marrington Dingle, where again fossils may be collected, to the igneous hill of Corndon whence the distance is not great to Lydham Heath railway station.

V. From Shrewsbury the junction of the Keuper with the Bunter formations may be examined at Grinshill. The train should be taken to Yorton station, whence the distance to the quarries is about a mile. In these beds have been found the remains of the *Rhynchosaurus* of which one good specimen is in the British and another in the Shrewsbury Museum, also footprints of that remarkable animal, and fine examples of ripple marks are abundant.

VI. *(a.)* Church Stretton is a good centre from which to explore the geology of the surrounding district. Within a short distance of the town along the Shrewsbury road, the peculiar corrugated structure of the lower beds of the Cambrian may be observed, and their thickness is well displayed in the valley which leads to the Light Spout. Specimens of the tracks of *Arenicola didyma* abound in the river bed. The alternation of purple and green beds should also be noticed.

(b.) The road may be taken to Little Stretton, close to which, at the edge of a small wood, the Llandovery, with characteristic fossils, is exposed. A walk up the Ashes Valley leads to an exposure in the rock where fine examples of worm tracks and ripple marks are plentiful.

(c.) East from Church Stretton, we find at Hazlar Hill Precambrian exposures, and following the road to Hope Bowdler a remarkable conglomerate may be seen in a road cutting. Here also are quarries well displaying the Precambrian. Within a short distance is the large quarry of Soudley, in which *Didymograpsus pristis*, *Trinucleus concentricus*, and a species of starfish have been found.

(d.) An interesting excursion from Church Stretton may also be made under the west of Caradoc, where, close to Botville, a large mass of Wenlock Limestone rests, highly inclined, on the flanks of the hill. The existence of this rock at such a spot, lying between the Caradoc strata on the one hand, and the Cambrian on the other, and completely isolated from the rest of the formations to which it belongs, is an instructive study in relation to the series of events and the forces which have disposed the rocks in their present position. Continuing our course northwards, the lower beds of the Caradoc Sandstone are found in the Lawley, from the northern end of which a line taken in a south-easterly direction traverses a highly interesting section. Crossing the valley, scooped out of Shineton (Tremadoc) Shales, to the Hoar Edge ridge, we find the equivalent of the Corston grit; thence to Chatwall, where the Soudley Sandstone is exposed and an overlying band of impure limestone, shown more fully to the N.W. at Broome. Cross by Plaish Park to Plaish. At the Sheaves farm close by may be seen the Upper Llandovery, with *Pentamerus oblongus;* then by the Holt and Red House (through Wenlock Shale), up Easthope Wood, where many fossils may be collected; over the scarp of Wenlock Limestone, to Easthope village, where we find the Lower and Upper Ludlow dipping under the old Red at Brockton. The observer should notice in the above excursion the gradual change from a high angle near the centre of upheaval at the Lawley, to a low one where the old Red succeeds, as well as the fact that the ridges of Hoar Edge, Chatwall, Plaish Park and Wenlock Edge are due to the hardness of the rock at their crests, which has thus resisted the denuding forces which scooped out the intervening and softer shales into valleys.

VII. Some three miles south of Church Stretton the Marshbrook station affords a good centre for exploration. To the east, in a steep road winding through the woods of Acton Scott, many exposures occur, and several Lower Silurian forms may be collected. Another path through the same woods, but in a S.E. direction and starting from the cottage by the high road, leads to the old Elizabethan manor house of Acton Scott, and passes by some exposures on the left, where some excellent specimens have been collected. There are also some good exposures in the grounds of Acton Scott.

At Marshbrook station is an old quarry charged with a variety of fossils, and, close by, a road leads towards Mindtown, where the relation of the Llandovery to the Cambrian may be well observed, and the line of their junction clearly made out. Starting again from the same station southward along a lane, within half a mile a large quarry on the right hand side among the woods will repay a search. Lastly, the road to Cwm Head which leaves the station towards the west, leads within a couple of miles to Broken Stones, so called from the masses of rock which owe their irregular form to the faulting and contortion to which this district has been subjected. Here are found the Corston grits and the Longmynd strata, in close proximity. This road leads to Horderley, which will be presently described.

VIII. *(a.)* The next station in order is that of Craven Arms, a place which affords exceptional facilities for examining the typical district, both from its central situation and the number of railways which converge here. Leaving the station by the Shrewsbury road, and striking into the fields on the right bank of the Onny at Strefford Bridge, within a quarter of a mile a fine exposure of Wenlock Shale in the bed and sides of the river is reached, good specimens of *Phacops longicaudatus*, of large *Graptolites*, and some rare forms may be procured. Higher up, where the river has undermined the bank, may be seen the purple beds or lowest layers of this formation, and still further on, the famous "Onny section," where the succession of Wenlock, Llandovery, (which is however only represented by a few calcareous courses), and the upper beds of the Bala or Caradoc can be seen in their normal position. A few yards higher up the stream, in the bed of the river, is a stratum of bluish shale, containing a vast collection of fragments of *Trinucleus concentricus*, with other remains. Near the river, on both banks, many other exposures will be found, until at Horderley a large quarry displays a fine section of thick bedded purple and green sandstones, and abounds in a variety of characteristic forms. These beds which are inclined at an angle of 5° are found a little further on to rest on others at an angle of 75°, proving the existence of a vast disturbance of the strata, being a continuation of that which has been observed at Broken Stones. A quarry in a thick bed of limestone, which is a portion of the Corston grit bed, and, a little further on, a stratum of Cambrian sandstone resting conformably on the last named rock, will next demand attention; but the disarrangement which has here taken place in their relative position, makes the geology of the locality difficult to determine. We next find exposures of the Wenlock Shale, underlaid on the south-eastern and western flanks of the Longmynd by the Mayhill Sandstone, and a well marked conglomerate (Mayhill), which, with the *Pentamerus* limestone bed, is well exposed a short way up the hill. Thence, pursuing the road by the south of the range, Plowden station on the Bishop's Castle line is reached, beyond this, in a deep cutting, the grey and purple strata of the Wenlock are exposed, and the same may be traced in other spots in the neighbourhood. Before leaving this place a visit should be paid to a fine conglomerate of great thickness on the western slopes of the Longmynd, probably of the same age as that which has been noticed at Sharpstones and Lyth Hill, near Shrewsbury.

(b.) Diverging from the route just described at Longville Common, the summit of Wartle Knowle can be reached. This, which is coloured in the geological maps as belonging to the Cambrian, is believed by Dr. Callaway to be a portion of the Precambrian, and is well worth a careful examination; from this point Craven Arms can be reached by Long Lane, in which are good quarries of Horderley Sandstone.

(c.) Again, leaving Craven Arms by the Corvedale road, and turning off to the left near Halford, by a lane up the hill, in the sides of which exposures of Lower Ludlow may be found, we reach a spot at its highest point, where a fault has brought the Wenlock limestone into close proximity with the Aymestry, and we thence descend into the valley of Dinchope, which runs between the two ridges, and is continued in a north-easterly direction for about 20 miles. A return can be made thence to Craven Arms by Grinnels Cross. Near the top of the road leading to this latter place, is an old quarry in which several good specimens have been found, among them the rare *Gomphoceras Bohemicum.*

(d.) One of the most instructive sections which the Geologist can explore may be examined by again leaving Craven Arms by the Corvedale road. Within about half a mile, near Halford vicarage, he passes over an outcrop of Wenlock Limestone. Further on are large quarries of Aymestry Limestone well displaying its thickness and characteristics. Turning to the right from the high road at Grinnels Cross, the Aymestry may again be noticed in a quarry on the right hand side. From this, the road leads to Norton farmhouse; opposite to which, on the right, and up the lanes leading to Norton Camp at the summit of the hill, are good exposures of Upper Ludlow, where some fine specimens of *Homolonotus Knightii* and several other fossils have been collected. In a lane, behind a cottage to the south of the farmhouse, and but a few yards off the road, is to be found the finest exposure known of the Ludlow bone bed. It is here in some places six inches thick and forms at one spot the bed of the lane itself. About a yard above it there is a bed of shale abounding in *Platyschisma* and *Modiolopsis Lævis.* It is remarkable that a bed in the same relative position exists at Ludlow and Downton Castle, where also the bone bed is found. A few yards further towards the east the Downton Sandstone may be detected overlying the above strata and conformable with them. Leaving Norton, the road may be taken to Onibury, at a short distance from which the Transition beds, preserving the same characteristics as they present at Ludlow and the Tin Mills, will be seen in the side of the road which passes through them, and their relation to the old Red strata, also exposed here, can be clearly made out. Fossils are not numerous, but specimens of *Eurypterus* have been procured. Nearer Onibury is a large quarry of Downton Sandstone in which *Lingula cornea* and many carbonaceous fragments abound. About a quarter of a mile from Onibury on the road to Craven Arms is a large and prolific quarry of Upper Ludlow. A mile further on, a wooden

bridge across the Onny river leads into the meadows on the right bank. Passing under the railway arch, and proceeding northward, some limekilns are reached which have been built to burn the Aymestry limestone, here somewhat displaced by fault. A little further on, overshadowed by some large elms, is a quarry rich in specimens belonging to the Lower Ludlow rock. Here have been procured *Acidaspis*, *Ischadites*, *Trochoceras (Lituites) giganteum*, *Nautilus Holtianus*, *Euomphalus*, and a variety of fossils too numerous to mention. The visitor to this beautiful valley will do well to finish his day's ramble by exploring the fine fortified Edwardian mansion of Stokesay Castle. A divergence from the above route may be made at Stoke farm buildings to the summit of Weo or View Edge, where in some extensive quarries, the Aymestry limestone, which forms the crest of this as well as of the opposite hill of Norton Camp, is well displayed, and the characteristic fossils abound.

(e.) Taking the train from Craven Arms to Broome and leaving this station in a westerly direction, the Corston Grits will be found near a farm of that name on the side of Clunbury Hill, brought by fault into close proximity with the Ludlow Shales, of which a vast expanse lies to the west.

(f.) Within about two miles of Bucknell station, on the same line of railway, is Pedwardine, remarkable for its exposures of Shineton Shales. Here the relative position of Mayhill or Llandovery Sandstone should be observed, as well as the quarries in Brampton Brian Park, where highly inclined Cambrian grits, and Precambrian rocks are found.

(g.) The neighbourhood of Clun is interesting from the large amount of boulders which are scattered over the surface of the Black Hill which have probably been transported by ice from the flanks of Plinlimmon and the adjacent mountains. These have in some instances been used by the pre-historic inhabitants of this district in the construction of the stone circles and dolmens of which the remains are still to be found.

The best localities for fossils in this neighbourhood are—

(1.) Radnor Wood, one mile east of Clun on the road to Craven Arms. (*2.*) Rock of Woolbury on Black Hill; one and a half miles S.E. of Clun. *(3.)* Rock Hill one mile S.W. of Clun. All three belong to the Upper Ludlow formation. The Transition beds between the Ludlow and the old Red are also to be observed, but no fossils have as yet been discovered in them.

IX. Since Ludlow is situated close to the boundary of Shropshire, the river Teme separating it from Herefordshire, the explorations of the geologist in its neighbourhood must necessarily extend into the latter county. We shall have therefore, in describing the following routes, to depart slightly from our original plan, and to carry our researches to a short distance over the limits of Shropshire.

(a.) In the immediate vicinity of the town itself several good points of observation are afforded. In the beautiful walk below the Castle and in the road lower down, the Upper Ludlow rock has yielded several fine specimens of *Homolonotus Knightii* to the hammer of Mr. Cocking. Crossing Dinham Bridge, at the foot of Whitcliffe, there is a section of the uppermost beds of the Aymestry Limestone which abounds in fossils, some of them very rare. Here have been found *Ceratiocaris, Encrinurus punctatus, Lichas Bucklandii,* and *Proetus Stokesii.* Whitcliffe Hill is chiefly composed of Upper Ludlow rock of which a large quarry faces Mill Street, replete with a variety of remains, among which may be mentioned *Pteraspis Ludensis* and *Pterygotus problematicus.* Not far from this quarry is Ludford Lane, distinguished as the locality in which the famous bone-bed was originally detected. The position of this interesting deposit in relation to the strata above and below it can here be very well studied. As at Norton, it is overlaid by Shales containing a quantity of the *Gasteropod Platyschisma Helicites, &c.,* and about a foot below it, a bed containing *Eurypterus pygmaeus* and *E. accuminatus.* In this stratum besides the curious *Onchus* spines and fragments of fish defences, a variety of remains of the highest interest may be collected. At the south end of the tunnel close to the Railway Station, the Passage or Transition beds between the Silurian and old Red formations were largely exposed during the construction of the railway, and yielded a rich collection of fossils, including two new *Cephalaspidæ,* viz.: *C. Ornatus* and *C. Murchisonii, Auchenaspis Salteri, Pterygotus, Eurypterus, Beyrichia, &c. &c.* A good section displaying the same formation will be found in the right bank of the river Teme, below the weir, about a quarter of a mile from Ludford Bridge.

(b.) Leaving Ludlow by the New Bridge, a large Upper Ludlow quarry will be found at a little distance to the left, which contains an abundance of characteristic fossils, and to the south of Oakly Park, above Hill Halton, a small quarry exhibits the marly beds of the old Red which underlie the cornstones. This is the only place in this stratum in which Mr. Marston, that most industrious collector, has found organic remains, viz.: those of a species of *Cephalaspis.*

(c.) Few excursions in this district will be found more instructive and enjoyable than the following. Leaving Ludlow by the Shrewsbury road, turn off at Bromfield to the left towards Leintwardine. Within a couple of miles the road winds up a hill over the lower strata of the Downton Sandstone, and passes by a large quarry of the Upper Ludlow on the left, and still further on, several exposures of the same: on reaching the crest of the hill over Leintwardine, from which a grand view of the valley of the Clun, with Coxwall Knoll and Brampton Brian Park in the distance, is obtained, we enter the extensive quarries of Aymestry Limestone. Here a very fine and interesting section is displayed. The thick beds of the Limestone are seen to be overlaid by slaty flags, and in these latter, which appear to be identical with those of

Church Hill, presently to be described, *Star Fish*, *Pterygotus*, and several other remarkable fossils, generally supposed to be characteristic of Lower Ludlow rock, have been found. The fact, however, that this stratum overlies the Aymestry seems to confirm the conclusion arrived at by Mr. Lightbody, and alluded to by Sir R. Murchison in his Siluria, that the Limestone properly belongs to the Lower and not the Upper Ludlow rock. Otherwise, it may appear that it cannot be considered as a boundary between the two, but only as a local calcareous deposit.

We may now either descend the steeply inclined road to Leintwardine by Mocktree, by which a magnificent section of the Aymestry and Lower Ludlow may be studied, or, better still, strike across a couple of fields by the top of this great quarry into an old road, on the right of which a quarry displays the same succession of Limestone and overlying Church Hill slaty shales, and in these *Star Fish* and *Ceratiocaris*, *&c.*, have been collected. From this point we descend to Leintwardine and again diverging to the left, reach the far-famed Church-hill. Here, several years ago, a rich harvest of *Star Fish*, *Crinoids*, *Pterygotus*, and other rare and interesting forms was collected in some newly opened quarries. These are however unfortunately filled up, and the supply has at present nearly ceased. From the summit of this hill an old lane leads to Trippleton farm, close to which is another good quarry replete with fossils. The road should then be pursued for about a mile to where another crosses it at right angles, and from this spot an excellent view is obtained of the Valley of Wigmore. Ridges of Wenlock and Aymestry Limestone run round the great amphitheatre of which the centre has been hollowed out by denudation, leaving the Wenlock Shale exposed in the lower parts. Under the overhanging banks of the river which winds through this valley, excellent specimens of *Phacops longicaudatus* and other characteristic forms may be collected. The road may now be taken either to Burrington, where the Wenlock Shale is well exposed, or back to Ludlow by Downton. On ascending the hill towards the latter place, a steep lane to the right leads down to the banks of the Teme, at the Bow Bridge. Here is displayed a fine cliff of Aymestry as well as exposures of Lower Ludlow prolific in good specimens. Lower down the river, near the Forge Bridge, in the road which has been deeply cut into the rock, on the left hand side as you descend, at the height of about six feet, the Bone bed already described may be examined.

(d.) The following route is recommended as well for its Geological interest as for the beauty of the scenery through which it lies. Leave Ludlow for Richards Castle by Ludford Bridge. In a hollow running up the hill to the right, about a quarter of a mile from the town, many good specimens from the Upper Ludlow have been found. Further on, Mary Knowle Dingle furnishes many exposures; and still further, at Batchcott, some extensive quarries are well worthy of a search. On reaching the Rectory of Richards Castle, the road should be taken up the hill to the right, and

soon the Church will be reached; passing which as well as the ruins of the old border fortress, we arrive at a beautiful spot known as the Bone Well; where a clear spring issues from among masses of Aymestry Limestone, in which have sometimes been found the whitened bones of frogs and other small animals. A pathway up the hill and over some undulating ground leads at last to the top of Evenhay Lane, descending which to Elton, and near the bottom of it, some capital fossiliferous exposures of Lower Ludlow will be found. Elton Lane, which is also deeply cut into the rock, and therefore affords an excellent section of the same formation, may then be ascended, and a pathway from the summit under the high Vinnals leads to a road on the south of Bringewood chase, by which a return may be made to Ludlow. Several good exposures of Aymestry limestone and of Ludlow rock will be observed on the way, in one of which the peculiar spheroidal structure which is sometimes found in these rocks, is well displayed.

(e.) The wild and secluded district north of the Tittestone Clee Hill may be best reached from Ludlow by way of Cleobury Mortimer. Here are found the upper yellow beds of the old Red Sandstone, which are interesting as having yielded fossils similar to those of Dura Den in Scotland, described by Hugh Miller, such as the ***Pterichthys*, *Holoptychius*, &c.** There is a fine exposure of mountain Limestone at Farlow, where excellent specimens of the palatal teeth of *Orodus ramosus*, *&c.*, may be found.

◆

Part 3.

CLASSIFICATION OF FOSSILS.

IN entering upon this portion of our work, we would call attention to the remarkable changes which have taken place from time to time in the prevailing forms of animal life. While a few genera, such as *Lingula*, have been strikingly persistent from the earliest period of which we have any record down to the present day, the duration of others has been confined within more narrow limits. For example, the *Trilobites*, which constitute so remarkable a feature in the Silurian age, appear to have died out altogether at the close of the Carboniferous, although their allies the *Phyllopods* have still some representatives. Again, the bivalve *Brachiopods*, which swarmed in the Silurian seas, have ever since been gradually disappearing, though they are not yet extinct; while the more highly organised *Lamellibranchs (Pelecypoda)*, of which there were but few types in Palœzoic times, have been continually on the increase. Once more, the *Cuttle fishes (Octopoda)*, the *Nautilus (Tetrabranchiata)*, and a very few other forms, are the sole descendants of a numerous and often gigantic race of *Cephalopods* of the primæval ocean. These organic changes, as well as the tendency which may be observed throughout all time to replace lower by higher types, have an important bearing upon one of the most interesting questions of our day, viz.: that of the development of species.

The classification of organic beings, to be accurate and complete, should be based on a knowledge of their development and growth, as well as of their internal and external structure. Of these conditions the last alone is, for the most part, available to the naturalist in assigning to fossils their proper place in the scale of organised creatures: the softer tissues have perished, and only the shells and bones to which these were once attached remain for our information: hence arises the uncertainty which often attends this subject, and the necessity—as we gain additional information by the discovery of fresh specimens —of modifying the conclusions which have been from time to time arrived at: hence too the difficulty, which the student must experience, from the multiplication of names and the re-arrangement of species. There are, however, certain broad lines of distinction which it will be possible to draw; and we therefore propose in the following sketch to describe a few of the main features by which the great families and genera of extinct animal life appear to have been connected with those of the present day, and wherein they differ from them and from each other, and thus to render some assistance to the student in arranging his collections. Those who desire to enter more deeply into the organisation and classification of palæozoic remains should consult Nicholson's "Manual of Palæontology," Woodward's "Recent and Fossil Shells," Lyell's "Student's Elements of Geology," &c.

The following are the chief divisions of the animal kingdom :—

SUB-KINGDOM I.—PROTOZOA.
——— II.—CŒLENTERATA.
——— III.—ANNULOIDA.
——— IV.—ANNULOSA.
——— V.—MOLLUSCA.
——— VI.—VERTEBRATA.

SUB-KINGDOM I.—PROTOZOA.

The animals included in this division are generally of minute size, and, for the most part, are composed of a structureless jelly-like substance, and possess no definite nervous or digestive apparatus. They are represented in the present day by several orders among the Foraminifera and the Protean animalcules such as the *Amœba.* The only genus with which we are concerned which can with probability be referred here is that of *Stromatopora* (Pl. vii. fig. 161). This fossil is found in the Silurian and Devonian rocks in masses of varying shape and size, and sometimes grows parasitically on shells and corals. Its essential features are concentric laminæ separated by interspaces, sub-divided by vertical pillars or partitions. The whole mass of the fossil is penetrated by pores and canals, and the surface often exhibits conical elevations or papillæ. It is probably allied to the sponges. The curious fossil *Ischadites Kœnigii* (Pl. xvii, fig. 552), as well as *Sphæospongia* (Pl. iii. fig. 48), may also be possibly referred to this sub-kingdom.

SUB-KINGDOM II.—COELENTERATA.

Animals whose alimentary canal communicates freely with the general cavity of the body. Most of them are furnished with tentacles, and the organs of the body present a radiate appearance.

CLASS A.—HYDROZOA. SUB-CLASS I.—HYDROIDA.

ORDER I.—TUBULARIDA. *Genus (1).—Labechia.* (Pl. ix. fig. 193). The surface is studded with blunt spines which, in vertical sections, are seen to be the summits of pillars; the spaces between these are occupied by calcareous plates; it is free from apertures, and the animal was attached at one point only to the substance over which it grew.

ORDER II.—THECAPHORA (OR SERTULARIDA). Animal compound and plant-like, consisting of numerous polypites protected in small cup-shaped expansions on the branches, called *hydrothecæ*. The genera *Ptilograptus*, *Callograptus* (Pl. xviii, figs. 581, 582), and *Dictyonema* (Pl. i, fig. 3), may have belonged to this order. The last named superficially resembles *Fenestella* (which belongs to the *Polyzoa*), but the latter have a calcareous skeleton and possess no cellules.

SUB-CLASS II.—GRAPTOLITIDÆ.—A large and important family confined to the Silurian rocks. They are known by their toothed or serrated appearance and resemble the living *Sertularians* in some respects, but differ from them in having been apparently unattached and in possessing a solid axis which is never present in the latter. The general horny covering of the *Graptolites* extended over the hydrothecæ or cup-like projections in which the polyp dwelt. There is reason to suppose that the axis which connects the hydrothecæ was not solid but was filled with living material. It is generally extended beyond one, and, in some genera, beyond both ends of the polypary. The cellules are separated from each other by partitions, but communicate by canals, and each opens at its apex by a distinct mouth through which the polypite extended its tentaculite head. Two predominant forms may be noticed in this sub-class. In one (*Diplograptus*), the serratures run along both sides of the axis (Pl. ii, fig. 29), and this form seems to be limited to the Lower Silurian rocks; in the second (*Monograptus*), they are confined to one side. The polyparies of the latter are also in some early genera divided into two (*Didymograptus*), and, in some foreign forms, into four and more branches (Pl. i, fig. 17).

CLASS B —ACTINOZOA.

Stomach opening into the body cavity and not identical with it, as in the last class.

ORDER I.—ZOANTHARIA. SUB-ORDER, SCLERODERMATA. SECTION I.—TABULATA. This section of *Actinozoa* includes corals which, though in many respects unlike each other, correspond in this, that the corallites or small tubes occupied by the animal are not divided vertically by septa or plates, as in *Omphyma*, &c., but transversely by *tabulæ* into many distinct stories (*Heliolites*, *e.g.*)

FAMILY I.—FAVOSITIDÆ.—Tabulæ well developed; septa rudimentary or absent; walls of the corallites with pores or apertures; corallum massive, or branched.

Genus (1).—Favosites. (Pl. viii, fig. 180, &c.) The corallites are more or less prismatic, *i.e.*, the walls are flattened, honeycomb fashion, and are perforated by one or more rows of pores.

Genus (2).—Alveolites, resembles the preceeding, but its corallites are short and oblique (Pl. vii, fig. 165). Nearly allied to the same genus is *Cœnites* (Pl. vii, figs. 167, 168).

FAMILY II.—CHŒTETIDÆ. These corals, similar to the last in the absence of septa and the possession of tabulæ, are distinguished from them in the fact that the walls of the corallites are without pores. (Pl. vii, fig. 166). The corallum itself assumes various forms, being sometimes massive, or branched, or laminar, or encrusting, and the corallites are of small size.

FAMILY III.—HALYSITIDÆ. Septa rudimentary; tabulæ well developed.

Genus (1.)—Halysites or the chain coral (Pl. viii, fig. 187). The long tubular corallites are united in lines so as to form vertical plates having interstices between them. The septa are 12 in number and are close to the walls.

Genus (2).—Syringopora. (Pl. vii, figs. 157, 159). Allied to Halysites, but the "Corallum is fasciculate, the corallites cylindrical, long, and united by hollow, tubular, horizontal, connecting processes; so that though the wall is imperforate the visceral chambers of contiguous corallites are placed in communication." The tabulæ have the form of funnel shaped plates.

SECTION II.—TUBULOSA. To this group belongs *Aulopora*, of which the corallites are pear-shaped, without tabulæ, and the septa merely indicated by striæ on the walls of the cells. The systematic position of the section is however doubtful.

ORDER II.—RUGOSA. This order includes a very large proportion of fossil corals and seems to have disappeared, with one exception, with the Palæozoic epoch. Its chief characteristics are 1st, that the septa generally consist of four and multiples of four, whereas those of modern corals included in the order *Zoantharia*, in other respects resembling these, consist chiefly of six and multiples of six. 2nd, the septa in the adult are generally of two sizes only, and their complete arrangement is often rendered irregular by the presence of a vacant space known as the *fossula*. 3rd, both septa and tabulæ are generally present; whereas in Zoantharia, where one is conspicuously present, the other is generally undeveloped; and lastly, the corallites are not connected interiorly.

FAMILY I.—CYATHOPHYLLIDÆ. A large family in which the septa are not, except in a few cases, quadripartite, or divided into fours. Tabulæ are always present.

SECTION I.—ZAPHRENTINÆ. Corallum free, conical, discoidal, or cylindrical; tabulæ complete; septal fossula present. To this group may possibly belong the genus *Petraia*. (Pl. v, fig. 104).

SECTION II.—CYATHOPHYLINÆ. Corallum may be simple or compound; septa more or less radiate; fossula generally absent; tabulæ confined to the central area.

Genus (1).—Cyathophyllum. (Plate vii, fig. 170, &c.) Corallum may be single or compound, and the septa, which are well developed, are twisted in the centre so as to form a kind of column.

Genus (2).—Omphyma, (Pl. viii, fig. 173, &c.), is closely related to *Cyathophyllum*. The septa are divided into four groups by shallow depressions or fossulæ, and the corallum was attached by root-like projections from its base or outer wall.

Genus (3).—Acervularia (Pl. vii, fig. 155), though resembling compound forms of *Cyathophyllum* in many respects, is distinguished by the central circular space being surrounded by a secondary wall. *Strombodes* differs from *Acervularia* in possessing funnel shaped tabulæ.

Genus (4).—Lithostrotion (Pl. xx, fig. 710-12), abundant in the carboniferous limestone, also belongs to this family, the corallites, which are prismatic or cylindrical, are tabulate, and have a distinct column running up their central axis, (*columella*).

It is probably to the family *Cyathophyllidæ* that the discoidal form *Palæocyclus* (Pl. xi, fig. 205-6), belongs

FAMILY IV.—CYSTIPHYLLIDÆ. (Pl. viii, fig. 175). The corallum is usually simple but occasionally compound. The septa are rudimentary and appear as striæ or ridges within the calyx or cup of the coral. The mass of the coral is composed of cellular or lenticular-shaped bodies.

ORDER III.—ALCYONARIA. *Genus (1).—Heliolites.* (Pl. viii, fig. 188). Corals composed of tubes of two sizes, the larger of which alone have rudimentary septa but both possessed tabulæ; cœnenchyma abundant. In the modern representatives of this family the polyps possess eight tentacles.

SUB-KINGDOM III.—ANNULOIDEA.

In this sub kingdom are placed those animals of which the alimentary canal is distinct from the general cavity of the body, and in which the body does not consist, as in the next group, of definite segments provided with appendages arranged in pairs such as are found in the crustacea, &c. Among their representatives in the Palæozoic era are the ***Asteroidea*** or Star fishes. The body of these is pentagonal and consists of a central disc in which is situated the mouth. The arms, of which there are generally five, are hollow, and contain prolongations of the stomach; they are grooved underneath, and from the grooves the tube-like feet protrude in two rows. Owing to the imperfect state in which the more perishable portions of fossil star fishes are preserved, it is difficult to assign their position among known genera.

Genus (1).—Palæaster. (Pl. xvii, fig. 547, &c.) Disc very small, the grooves in which the tube feet are placed were furnished with two rows of ossicles and pores, bordered on each side by an inner and outer row of calcareous plates. This genus comprised some species of considerable size.

Genus (2).—Palasterina. (Pl. xvii, fig. 543). Disc much enlarged, and the plates which surround the mouth large and triangular.

Genus (3).—Protaster, (Pl. xvii. fig, 538), probably belonged to the order *Ophiuroida* which is characterised by the disc having contained all the internal organs of the animal. The arms are not grooved beneath for the insertion of tube-feet, and the mouth appears to have been furnished with a masticatory apparatus.

ORDER II.—CRINOIDEA. The Crinoids or sea lilies were fixed to the sea bottom by means of a stalk of varying length, jointed and flexible. The head is cup shaped, and furnished generally with five or ten branched arms which are grooved on their upper surfaces. From it rises a proboscis-shaped tube, which is sometimes of great length, and which is supposed to be anal in its functions. At the extremity of this tube is often found a small univalve shell called *Platyceras.* It was originally supposed that in such cases the crinoid was in the act of eating the mollusc when it perished. It having, however, been observed that the shell must have been long attached to the proboscis, since its lip has become worn to the shape of its surface, it is more probable that the mollusc attached itself to the crinoid for the purpose of feeding on the excreted fragments of the animalculæ which formed the food of the latter. The arms which spring from the margin of the calyx are united to it by plates, the number and character of which are of importance in classification. The plates next the stem are called "*basals,*" the row outside these "*parabasals,*" and the first joints of the arms, before subdivision has taken place, "*radials.*"

Genus (1).—Cyathocrinus. (Pl. ix, fig. 224). Basals five, alternating with five parabasals; the arms generally have three radials. Allied to this genus is—

Genus (2).—Ichthyocrinus, (Pl. ix, fig. 223), in which the arms are frequently bifurcated.

Genus (3).—Taxocrinus. (Pl. ix, fig. 226). Basals very small. Parabasals five, large, succeeded by from three to seven radials in each arm.

Genus (4).—Actinocrinus, to which *genus (5), Periechocrinus* (Pl. ix, fig. 221), is closely allied, has three basals and three systems of radials. The parabasals are absent.

Genus (6).—Platycrinus. (Pl. ix, fig. 228). The cup consists of three basals, which each support two sets of radial plates of which the primary ones are much the largest. The secondary radials bear bifurcated arms and these are fringed with pinnulæ or filaments.

Genus (7).—Euclayptocrinus. (Pl. ix, fig. 222). The calyx is deeply concave at the base like the bottom of a wine bottle. It has four small basals which carry five large primary radials, these are succeeded by others, and the last are developed into long club-shaped processes which lie in grooves formed by the sides of the calyx. The type presented by this last genus is in many respects very unlike that of the preceding.

ORDER III.—CYSTOIDEA. Resembling the Crinoids in the possession of polygonal calcareous plates, but differing in the absence of arms, since the jointed processes which are attached to some of them bear a closer resemblance to the pinnulæ or lateral branches of the Crinoids. The Cystoids are confined to the Cambrian, Silurian, and Devonian eras. The functions of the curious cells and apertures seen in some of the plates with which they were covered, are little understood. We shall only briefly indicate the chief characteristics of some of those which are figured.

Genus (1).—Apiocystites. (Pl. ix, fig. 212). Five grooves on the surface which appear to correspond with arms bordered on each side by a row of short pinnulæ. The body is oblong and tetragonal.

Genus (2).—Prunocystites, (Pl. ix, fig. 211), possesses long free branchial processes in the place of arms.

Genus (3).—Echinoencrinus, has a calyx composed of four sets of plates:—four basals and five plates in every range: above this it also has three plates perforated with minute pores or fissures, "pectinated rhombs," believed to be respiratory organs.

SUB-KINGDOM IV.—ANNULOSA.

Animals whose bodies are composed of a number of segments arranged one behind the other.

DIVISION A.—ANARTHROPODA. CLASS I.—ANNELIDA, in this class the segments are not articulated to the body, and the surface is soft, or only horny.

ORDER I.—TUBICOLÆ. *Genus (1).—Cornulites.* (Pl. x, figs. 232-3). The calcareous tube in which the animal lived and into which it had the power of retreating, sometimes attained the length of three or four inches. It is marked by a number of rings, finely striated.

Genus (2).—Spirorbis (Pl. x, fig. 231). This form has survived to the present day and is found attached as a parasite to other shells. The species resemble univalves, and may easily be supposed to belong to the *Gasteropoda;* but it is known from the analogy of existing species that the animal was not, as among the gasteropods, attached by muscles to the walls of its shell, and differs in this respect from them.

Genus (5).—*Trachyderma* (Pl. xvii, figs. 553, 554), is also referred to this order. The fossils figured are supposed to be the casts of the membranous tubes occupied by the worms.

ORDER II.- ERRANTIA. Animal not confined to a tube. The only traces known of them are their fossilised tubes, burrows, and the trails which they made on the mud and sand as they glided over it; and thus a creature as perishable and fragile as the ordinary earthworm has left behind it a record of its existence older than any other known fossil.

Arenicola and *Scolithus*, (Pl. i, fig. 1, 2 and 18), are examples of these. In the first, the depressions occur in pairs, and are caused by the fact that the anelid formed U-shaped burrows in the sandy or muddy shore of the period, of which these small depressions are the summits.

Serpulites Longissimus, (Pl. x, fig. 234, &c.) A common fossil in the Upper Ludlow rocks, which sometimes attained a great length, belongs to this group.

DIVISION B.—ARTHROPODA OR ARTICULATA.—The Annulosa belonging to this division possessed bodies composed of segments or "somites" to which were articulated certain jointed appendages, such as the swimming feet, claws, and feelers of the lobster. They are divided into the following four classes, of which we shall have occasion to notice only the first.

1.—CRUSTACEA (Lobsters, Crabs, &c.) 2.—ARACHNIDA (Spiders, Scorpions, &c).
3.—MYRIAPODA (Centipedes,) 4.- ·INSECTA.

The CRUSTACEA have been divided into several sub-classes and orders; the following include the fossils with which we are concerned.

SUB-CLASS ENTOMOSTRACA. ORDER 1. OSTRACODA. *Genus (1).—Leperditia.* Body enclosed in two unequal calcareous bean shaped valves. Near the hinge there is a small tubercular eye-spot, and the shell exhibits reticulated markings, and a groove extending a short way across the valves.

Genus (2).—Primitia. Carapace equivalve, convex, oblong, with a dorsal groove of variable length.

Genus (3).—Beyrichia. (Pl. x, fig. 238). Related to the last, but characterised by two or three transverse grooves passing from the hinge across the valves.

ORDER II.—PHYLLOPODA. *Genus (1).—Hymenocaris.* The carapace or shield, which covers the fore part of the body, is not apparently bivalved and is somewhat triangular. There are nine segments of the body and the last bears three spiked appendages or setæ.

Genus (2).—Ceratiocaris. The carapace is bivalved, the valves are united along the back, pod-like in shape, converge in front, and are truncated; behind them are fourteen or more body rings of which the last five or six are free. The tail, like that of the last, is terminated by three spines. Gill-like plates connected with the under surface of the caudal segments have been detected in some specimens. (Pl. xvii, fig. 566).

ORDER III.—TRILOBITA. In describing this important order of Crustacea we refer for the explanation of the terms employed to Pl. xxi, figs. 762-5.

As the name implies, the animals included in it present a more or less trilobed appearance. The body may be divided into three well marked divisions: (1) the head, (2) the body rings or thoracic segments, (3) the pygidium. The head, or cephalic shield, is composed of three pieces variously united together. The central one is called the "glabella," and varies much in form. It is bounded by two "axal" grooves, posteriorly by a third groove "the neck furrow" and is generally lobed transversely. It is probable that these lobes corresponded with certain appendages beneath, (jaw-feet, pincers, &c.), of which no trace has as yet been found. The small portions of the carapace which are continuous with the glabella are called the "fixed cheeks." These are separated by the "facial suture" from the "free cheeks;" and the course taken by this suture is of importance for purposes of classification. The free cheeks terminate behind in angles, "genal angles," which are sometimes prolonged so as to form spines, and they also support the eyes, which when present are usually compound. The number of lenses of which they are composed is very variable, there being in some genera as few as 14, and in others as many as 15,000. (Barrande).

The body rings, which are movable on each other, constitute the thorax. They vary from two to twenty-six, and were so constructed that the individuals of some genera, (Phacops, Deiphon, &c.), could roll themselves up into a ball like the wood-louse. Their trilobation is generally well marked. The central ridge is called "the axis," and this is separated from those on each side, "the pleuræ," by a groove, "the axal furrow." Each of the pleuræ is again, in some genera, grooved along its upper surface. Lastly, the tail or "pygidium" consists of a central lobe or axis and two lateral portions called "limbs." It is formed of several segments united together. But little is known of the under surface of trilobites. The head was furnished with two plates beneath, the anterior called the "rostral shield," and the posterior the "labrum." Recent researches have given reason to believe that, like other kindred crustaceans, they were supplied with legs and other appendages. The ova of trilobites have been observed: they are spheroidal or cylindrical in shape and are deposited in clusters. The only living creature which appears to represent this family, so important in the Silurian era, is the Limulus or king crab. This, in its larval condition, presents distinct traces of trilobation and bears a strong resemblance to Trinucleus. (Pl. iii, fig. 55).

The following are among the principal families and genera of Trilobites which are met with in the rocks under consideration.

FAMILY I.—REMOPLEURIDÆ. *Remopleurides* (Pl. iii, fig. 57), is the only genus which is contained in this family. The head is large and the cheek angles produced into outwardly bent spines. The glabella has lateral grooves and the sutures unite in front of it Eyes long and reticulated, enclosing the glabella. Eleven body rings, the seventh with appendages on the pleuræ. Tail very small and sometimes with but two segments.

FAMILY II.—OLENIDÆ. *Genus, Olenus.* (Pl. i, figs. 6, 7). Glabella contracted in front. Its furrows often extended across it. Fourteen spinose body rings whereas the genus *Paradoxides*, has from sixteen to twenty and the posterior head-spines as long as the body.

FAMILY III.—CONOCEPHALIDÆ. *Genus Conocoryphe*, (*Corda*). (Pl. i, fig. 9). This, as well as the preceding family, is only found in the Cambrian strata. It has some resemblance to *Calymene*. Glabella wide behind and contracted in front; facial sutures discontinuous. The fixed larger than the free cheeks. Fourteen or fifteen facetted body rings Tail has from two to eight segments with entire margin.

FAMILY IV.—PHACOPIDÆ includes one genus, viz.: *Phacops*. (Pl. x, fig. 249). The glabella very broad in front and with three lateral grooves. The facial suture cuts the external margin of the cheek. Eyes conspicuous, facetted, and reniform. Body rings eleven. Pygidium with from eight to fifteen segments.

FAMILY V.—CALYMENIDÆ includes two genera, *Calymene* (Pl. x, fig. 242), and *Homolonotus* (Pl. xvii, fig. 556). In both the glabella is widest behind and the facial sutures between the posterior and exterior margin. Eyes minute in the middle of the cheek, reniform and facetted. Thirteen convex body rings; pleuræ wider than the axis. Labrum notched. *Homolonotus* resembles *Calymene* in many respects, but the trilobation is much more imperfect and it is distinguished by the broad, highly convex thorax.

FAMILY VI.—PROETIDÆ. *Genus (1).—Proetus.* (Pl. x, fig. 257). Head semicircular. Facial sutures not continuous. Eight or ten body rings, grooved. Three pairs of lateral furrows. Eyes large, facetted. Pygidium, four to thirteen segments.

Genus (2).—Cyphaspis. Differs from the last in having a more convex glabella, ovoid, smooth, and remote eyes, gibbous cheeks, and eleven to seventeen body rings. The sixth segment bears a spine.

Genus (3).—Phillipsia. (Pl. xx, fig. 714). The general form like *Proetus* but body rings from nine to eleven. The tail semi-oval with entire margin; segments eleven to sixteen. Eyes large and reniform.

FAMILY VII.—LICHADÆ. Only genus *Lichas.* (Pl. x, fig. 259). Head very convex, semicircular. Central lobe of the glabella grooved behind. Facial sutures discontinuous. Eyes smooth and reniform. Thorax of eleven segments, with grooved, flat, falcate pleuræ; pygidium semi-oval; axis undefined, larger than the head, often spinose.

FAMILY VIII.—ACIDASPIDÆ. Contains but one genus, *Acidaspis.* (Pl. x, fig. 239). The head is short, broad, truncated in front, and marked by a second pair of axal furrows. Thorax has nine or ten segments, with a narrow, convex axis and horizontal pleuræ terminated by spines. Tail small and fringed with spines. Facial sutures continuous, ending on the posterior margin. Eyes smooth. Test highly ornamented.

FAMILY IX.—TRINUCLIDÆ. The general characteristics of this family are the great size of the head and its wide margin. Glabella conspicuous, pyriform, convex. Eyes generally absent. Body rings five or six, with grooved pleuræ; axis convex.

Genus (1).—Trinucleus. (Pl. iii, fig. 55). The margin of the shield is perforated by numerous punctures, and prolonged behind into long spines. Lateral grooves and facial sutures obscure. A small tubercle, possibly an eye, is sometimes found on the lateral lobes. Six body rings. Tail triangular; edge elevated.

Genus (2).—Ampyx. (Pl. ii, fig. 34). Glabella prolonged into a beak and long spine. Margin of shield not perforated as in *Trinucleus.* Eyes wanting. Facial sutures absent. Five or six body rings. Tail nearly triangular.

FAMILY X.—ASAPHIDÆ. Large Trilobites of oval form and never tubercled or spinous. Facial sutures terminating between the margin of the shield and the axis. Body rings usually eight, with grooved pleuræ.

Genus (1).—Asaphus. (Pl. i, fig. 10). General trilobation comparatively faint. Caudal shield at least equal to the head in size. Facial sutures discontinuous.

Labrum deeply forked. Tail with entire, rounded margin, and sometimes nearly without an axis; segments twelve to fourteen.

Genus (2).—Ogygia. (Pl. ii, fig. 39). Generally similar in form to the last, but axis of tail is more conspicuous. Glabella clavate, and distinctly furrowed transversely. The labrum is rounded and not cleft.

FAMILY XI.—ILLENIDÆ. *Genus, Illænus.* (Pl. iii, fig. 58). Head and pygidium large and convex. Axis in both very obscure. Axal furrows of thorax distinct, the axis itself moderately wide; eyes smooth, remote, and lunate; glabella obscure; rostral shield shuttle-shaped; body rings eight to ten.

FAMILY XII.—ÆGLINIDÆ. *Genus, Æglina.* (Pl. i, fig. 20). Eyes remarkably large. Segments of the thorax five or six. Both head and tail large, and in the latter the axis is truncated. Glabella not well defined. Facial sutures ending on posterior margin, close to the axis.

FAMILY XIII.—CHEIRURIDÆ. *Genus (1).—Cheirurus.* (Pl. vi, fig. 113). Head strongly trilobed, semicircular, with rounded or pointed genal angles and arched glabella, which is deeply furrowed with three lateral grooves forming three lobes. Body rings generally eleven, with slightly grooved pleuræ. Four distinct rings in the axis of tail, the pleuræ of which are terminated by spines or points.

Genus (2).—Sphrœrexochus. (Pl. x, fig. 254-6). Similar to *Cheirurus* in number of body rings and tail, but distinguished by the great inflation of the glabella, the facial suture ending on the external margin, and by having only three segments in the tail.

FAMILY XIV.—ENCRINURIDÆ. *Genus (1).—Encrinurus.* (Pl. vi, fig. 114). Glabella pear-shaped, with many tubercles. Lateral furrows very indistinct. Body rings eleven; on the 7th and 11th occasionally spines. Segments of the tail numerous; axis tubercular.

Genus (2).—Cybele, (Pl. iii, fig. 60), belongs to the same family. Three lateral furrows in glabella. Body rings eleven; the pleuræ ending in spines conspicuously directed backwards; pygidium triangular; axis rounded.

FAMILY XV.—AGNOSTIDÆ consists of several forms of which *Agnostus,* (Pl. i, 5), is the type, the head and tail are very similar in form, size, and markings. Segments of thorax only two, with grooved pleuræ. Eyes and facial sutures absent; the tail segment bears a small tubercle.

ORDER MEROSTOMATA. SUB-ORDER I.—EURYPTERIDA. These remarkable crustaceans were furnished with a head shield, bearing a pair of larval eyes near the centre, and a pair of large marginal or subcentral eyes besides. The mouth had a broad oval plate, "metastoma," and there were five pairs of appendages beneath; the anterior of which, though sometimes clawed, are supposed to be antennæ; the next three are simply spinous, and the last served as swimming feet, the bases of which formed powerful jaws. Behind the head were thirteen free segments counting the tail, without appendages. A plate or "operculum" was situated over the first two which probably protected the generative organs. There is every reason to believe that the berry-like bodies, which are found in strata where the remains of these crustaceans abound, described as *Parka decipiens* (Pl. xx, fig. 709), were the egg packets or ovisacs of the animals. The Sub-Order Eurypterida is divided into four genera, viz.: (1) *Pterygotus*; (2) *Slimonia*; (3) *Stylonurus*; (4) *Eurypterus*; for the description of which see Plates xxi and xxii.

SUB-ORDER II.—XIPHOSURA. *Genus.—Hemiaspis.* (Pl. xvii, fig. 569, and Pl. xxii, fig. 806-7). In this genus, interesting as a link between the ancient and long extinct family of the Trilobites and their only known living representative, the King Crab, the head shield resembles that of the recent Limulus, there are traces of facial sutures, the thorax has six free segments, and the tail is long and spiniform. It made its appearance only at the close of the Silurian epoch.

SUB-KINGDOM V.—MOLLUSCA.

The animals included under this head differ widely in their external form, but resemble each other in possessing soft bodies, in which the alimentary canal never communicates with the general cavity of the body. Although some of them, like the Cuttle-fish, possess an internal skeleton, this is never vertebrate; and though many are protected by shells and other external calcareous structures, like the *Polyzoa*, these are not arranged in segments. A nervous system of one, two, or three pairs of ganglia, sometimes a heart, and respiratory organs are present.

The Mollusca are divided into two great groups. The first, the *Molluscoida*, comprises the three classes of *Polyzoa*, *Tunicata*, and *Brachiopoda*; animals whose nervous system is confined to one or two pairs of ganglia, and in which the heart is either absent or very imperfect; the second, the Mollusca proper, comprises the *Lamellibranchiata*, *Gasteropoda*, *Pteropoda*, and *Cephalopoda*, in which a nervous system of three pairs of ganglia and a well developed heart are present.

CLASS I.—POLYZOA OR BRYOZOA. There is often so close a resemblance between the organisms included in this class, and those which have already been described as belonging to the *Cœlenterata*, that it is sometimes difficult to determine to which they should belong. In both, a large number of individuals are combined to form a compound coralline structure; but in this respect the two are essentially distinct, that, whereas in the Sub-kingdom *Cœlenterata*, the cells of the separate polypites communicate with the general cavity of the body, each individual in this class consists of a sac having apertures, one for the extrusion of the tentacles which surrounded the mouth of the animal, and one for the anus; the alimentary canal connects these, and floats in the fluid which fills the sac, without opening into it. We shall now describe a few of those forms which appear to be analogous to living structures, and have been named accordingly.

Genus (1).—***Fenestella.*** (Pl. xi, fig. 270). The calcareous structure which connects the polyp cells, and which is called the "cœnœcium" forms a fan-shaped expansion attached by its base to some object. It is composed of a number of parallel stems united by crossbars or "dissepiments." The outer surface of the branches is porous or striated, the cells are arranged in two rows along the inner surface, separated by a ridge or keel which itself sometimes has an additional row.

Genus (2).—***Retepora*** (or *Phyllopora*). Instead of crossbars the branches are united so as to form oval interspaces between them.

Genus (3).—***Polypora.*** (Pl. xi, fig. 277). The branches are not keeled, and have from one to five rows of cells, and the dissepiments are solid.

Genus (4).—***Glauconome.*** (Pl. xi, fig. 278). Cœnœcium irregularly branched. Stems not united by dissepiments. One side striated, the other exhibits cell mouths placed alternately. There are also cell mouths in the side shoots of the fronds.

Genus (5).—***Ptylodictya.*** (Pl. xi, fig. 282). This genus represents a considerable group of the *Polyzoa.* It consists of a flat frond upon which the cellules, with round or oval mouths, are placed obliquely. The margin of the frond is striated longitudinally and is destitute of cell mouths.

The genera ***Chætetes*** (Pl. vii, fig. 166), ***Monticulipora,*** (erroneously named ***Stenopora*** in earlier works), and others, which have been described under the Sub-Kingdom ***Cœlenterata,*** bear a general resemblance to the Polyzoa. Having however their tubes crossed by transverse partitions or "Tabulæ," as well as other affinities with ***Alveolites, Favosites, &c.,*** they remain, provisionally, in the former group.

CLASS II.—BRACHIOPODA. The invertebrates composing this class are mantle breathing bivalves, inhabitants of the sea, and are possessed of labial appendages, erroneously termed arms, and incorrectly supposed to be analogous to the foot of the Gasteropod, but through habit the name has been generally admitted.

Like the Lamellibranch their soft parts are protected by bivalve shells, but while the valves of the former are attached to the sides of the animal, those of the Brachiopods are applied, one to its ventral, the other to its dorsal surface. Moreover the two valves of the Brachiopod are sometimes slightly unequal to each other, and generally very much so, but are symmetrical, that is to say, a straight line drawn from the beak to the centre of the margin would divide them into two equal halves. Those of the Lamellibranch are equal but not symmetrical. They are often, from their resemblance to antique lamps, called "lamp shells."

In most Brachiopods the valves are connected by a hinge, having two teeth on the ventral and corresponding sockets on the dorsal or smaller valve. In some, such as Lingula and Crania, the articulation is absent, and the valves are kept in their place by muscles. Generally the ventral valve ends in a "beak" which is perforated by a hole called the "foramen;" through this passed a muscular cord or "peduncle," by which the shell was attached to marine objects; when it is absent, the peduncle passed between the beaks of the valves, as in Lingula, or the shell was attached to the rock by its surface, as in Crania.

The shells are opened by the action of two muscles, of which one extremity of each was attached to a projection in the dorsal valve, the "cardinal process," and the other on each side of the centre of the ventral valve. They were closed by "adductor muscles" (usually four in number). These have left scars at the places where they were attached to the shells, and which are of importance in classification. A space, sometimes considerable, between the beaks of the valves (Pl. xiii, fig. 423), is called the "hinge area;" and a triangular shelly plate in front of the foramen, which is however absent in some cases, is called the "deltidium."

The shell of the Brachiopod is formed of a number of flattened prisms regularly arranged parallel to each other at an acute angle with the surface, which thus, under the lens, presents a tessellated appearance. In most cases also, it is perforated by a number of pores or canals, and is then called "punctate."

The digestive organs of the animal occupied only a small portion of the interior cavity near the beak; the rest was filled with the long labial appendages, consisting of a flexuous membranous tube, fringed on one side by a double row of hollow cirri. These fleshy appendages are, more or less, supported by a calcareous process, varying in shape and extent in different families and genera. They are in some forms capable of movement.

The Brachiopoda are divided into two great groups:—

(*A*).—*Clistenterata* or *Articulata.* Those in which the valves are articulated by means of teeth and sockets.

(*B*).—*Tretenterata*, or *Inarticulata*. Those in which the valves are free.

A.—The *Clistenterata* or *Articulata* have been divided into several families.

FAMILY I.—*Terebratulidæ*. Arms supported by variously shaped calcified lamellæ in the form of loops; beak perforated by a circular foramen. This family comprises *Terebratula*, *Waldheimia*, and other genera.

FAMILY II.—*Spiriferidæ*. Arms supported by a long thin shelly process, spirally coiled: Spirals differently directed in different genera, and usually connected by a more or less complicated system of lamellæ.

Genus (*1*).—*Spirifera*. (Pl. xiii, fig. 428). Shells usually more or less transversely oval or elongated, hinge-line long and straight. Hinge area well defined and divided by a triangular fissure, partly arched over by a pseudo-deltidium. Bases of spirals facing each other, apices having a more or less upward direction towards the posterior angles of the lateral margins of the shells. Spirals not connected.

Genus (*2*).—*Cyrtia*. (Pl. xiii, fig. 423). Similar in shape to Spirifera but valves very unequal, ventral valve deep and conical, hinge area very large, foramen narrow arched over by a long narrow deltidium, perforated, up to a certain age, by a circular foramen. Spirals as in *Spirifera*.

Genus (*3*).—*Athyris*. (Pl. xiii, fig. 438). Shell biconvex, more or less circular, beak incurved, perforated by a small foramen. Spiral supports large, facing each other in the centre of the shell, apices directed towards the lateral margins of the shell, spirals connected by a complicated system of lamellæ.

Genus (*4*).—*Merista* like *Athyris* generally, but having a "shoe-lifter" shaped process in the interior of the ventral valve. (Pl. xxi, fig. 755). Spirals as in *Athyris* but differently connected.

Genus (*5*).—*Whitfieldia* (Pl. xiii, fig. 408), also much resembles the former. Spirals as in Merista, connections different, no shoe-lifter process.

Genus (*6*).—*Retzia*. (Pl. xi, fig. 311, &c.) Shell ovate. Spirals oval, direction as in Athyris. Loop connecting spirals, V shaped, with sharp angular extremity, sometimes prolonged into a spine-like process.

Genus (*7*).—*Atrypa*. (Pl. vi, fig. 135). More or less circular. Bases of spirals conical, directly facing the bottom of dorsal valve. Loop, connecting spirals, simple.

FAMILY III.—RHYNCHONELLIDÆ. Shell impunctate. Beak pointed, much incurved. Arms spirally coiled as in Atrypa, attached at their base to short curved processes.

Genus (1).—***Rhynchonella.*** (Pl. xii, fig. 322). Valves more or less unequally convex, dorsal valve elevated in front; foramen under the beak, and entirely completed by a deltidium.

Genus (2).—***Triplesia.*** (Pl. xxi, fig. 727). Transversely oval. Cardinal process in dorsal valve large and bifid.

Genus (3).—***Eichwaldia.*** (Pl. xii, fig. 386). Shell-surface reticulated. Shell more or less triangularly ovate.

Genus (4).—***Pentamerus.*** (Pl. xi, fig. 288, &c.) Shell ovate, ribbed or smooth, that of ventral valve containing a triangular fissure. Dental plates converging, trough like, supported on a prominent septum. Dorsal valve with two contiguous longitudinal septa.

Genus (5).—***Stricklandinia.*** (Pl. vi, fig. 133). Shell oval, but valves not disproportionally unequal; a short mesial septum in the interior of ventral valve supporting a small triangular chamber beneath the beak. In dorsal valve two short hinge plates with two calcified processes for support of arms.

FAMILY IV.—STROPHOMENIDÆ. This family is marked by having no calcified supports for the arms, hinge line straight, area triangular in each valve, shell fibrous or punctate.

Genus (1).—***Orthis.*** (Pl. xii, fig. 368, &c.) Hinge line generally shorter than the width of the shell. Valves semicircular, generally biconvex, area in both. Fissure open. Surface smooth, ribbed or striated.

Genus (2).—***Strophomena.*** (Pl. xiii, fig. 390). Shell semicircular, widest at the hinge line, one valve convex, the other concave; surface rarely smooth, generally striated. Hinge area double, with a triangular fissure in the ventral valve, arched over by a deltidium. Beak in the young of some species showing a small circular foramen. No processes for the attachment of the arms. In *S. Rhomboidalis* (Pl. xiii, fig. 390), the dorsal valve is concave, while in *S. Englypha* (Pl. xiii, fig. 394), it is convex.

Genus (3).—***Leptœna.*** (Pl. iv, fig. 73 and Pl. xxii, figs. 780-3). Very similar to the last, but may be distinguished by the long hinge line, the very curved shells, and the long muscular impressions. The dorsal valve is concave.

FAMILY V.—PRODUCTIDÆ. No calcified supports for the arms, hinge line straight, ventral valve convex, dorsal concave; rarely articulated with teeth. External surface studded with tubular spines. Shell punctured.

Genus (1).—***Chonetes.*** (Pl. xii, fig. 389). Hinge line as wide as the shell. Both valves have a hinge area, with central fissure, which in the ventral valve is covered by a deltidium; its hinge margin is also furnished with a row of spines.

Genus (*2*).—***Productus.*** (Pl. xx, fig. 715). Valves without teeth or sockets, transversely elongated and occasionally furnished with ear-like expansions. Surface ribbed or striated, and occasionally covered with spines. These spines seem in some cases to have supplied the place of the peduncle, anchoring the shell to various objects by getting entangled with them.

B.—INARTICULATA. Valves free.

FAMILY VI.—CRANIDÆ. Shell attached to submarine substances by the whole or part of the surface of one of its valves; upper valve limpet like. Structure punctate.

Genus.—***Crania.*** (Pl. xiii, fig. 454). Umbo or apex of dorsal valve, sub-central, or marginal.

FAMILY VII.—DISCINIDÆ. Shell attached by a peduncle passing through the ventral valve.

Genus (*1*).—***Discina.*** (Pl. xiii, fig. 445). Shell orbicular, horny. Upper valve limpet shaped, smooth or concentrically striated; lower valve flat or slightly convex, perforated with a slit situated in a depression of the surface.

Genus (*2*).—***Trematis.*** (Pl. iv, fig. 71) Both valves more or less convex. Ventral valve has a slit at the margin. Surface radiately striated and pitted.

Genus (*3*).—***Siphonotreta.*** (Pl. xiii, fig. 451). Shell oval, inequivalve. The beak of the ventral valve has a foramen which communicates with the interior by a tube. Surface concentrically ridged, and covered with delicate spines.

FAMILY VIII.—LINGULIDÆ. Shell attached by a peduncle passing between the valves. Texture horny, arms fleshy.

Genus (*1*).—***Lingula.*** (Pl. xiii, fig. 441). Shell oblong. Dorsal valve a little shorter than the ventral. Shells tapering towards the beaks.

Genus (*2*).—***Lingulella.*** (Pl. i, fig. 14). Differs from the preceeding in having a groove for the passage of the peduncle.

Genus (*3*).—***Obolus.*** (Pl. xiii, fig. 459). Valves orbicular, smooth. The ventral valve has a furrow for the passage of the peduncle.

Genus (*4*).—***Obolella.*** (Pl. i, fig. 13). Described by Mr. Billings as differing from the genus Obolus in having the smaller extremities of the two central muscular scars directed upwards, and diverging from each other, whereas in Obolus the arrangement is exactly the reverse. Mr. Davidson expresses himself with reserve about this distinction.

CLASS III.—LAMELLIBRANCHIATA OR CONCHIFERA. Molluscs included in this class have been so named from their possessing two lamellar gills or branchiæ on each side of the body. The animal is enclosed in a shell composed of two valves, generally united by teeth and sockets, but sometimes by a ligament. The shells of the Lamellibranchs in general are different from those of the Brachiopods in not being, as the latter always are, equilateral; but being, unlike the Brachiopods, mostly equivalve. At the same time this peculiarity has some remarkable exceptions as *e.g.*, the Oyster and Gryphea, which are very inequivalve, while in others, as in some species of Pecten they may be nearly equilateral.

The condition in which we find nearly all the specimens of Lamellibranchiate shells in the Palæozoic rocks, makes their classification a work of much difficulty and often of uncertainty. The shells of Brachiopods, from their compact structure, frequently preserve the marks made by the muscles and other organs of the animal which once occupied them; but the chief means we have to guide us in determining the genera, &c., of the former, is their external form. We shall therefore only indicate those external characteristics which afford the means of classifying them. The following definition of the terms used will help to shorten and render clearer our description. Each valve is essentially a hollow cone of which the apex is turned more or less to one side. This apex is called the "umbo." The side of the shell towards which the umbones incline is called its "anterior" side from the fact that the so called mouth is generally situated there; the opposite is called the "posterior." Again, that side on which the umbones are situated is called the "dorsal," and the opposite the "ventral" margin or "base." The valves will therefore be considered as right or left in relation to their anterior or posterior extremities when the shell is placed upright on its ventral margin. The length of the shell is measured from its anterior to its posterior margin, and its breadth from the dorsal side to the base.

Some Lamellibranchs possess what are called respiratory siphons, others are destitute of these organs; and the class is accordingly divided into two sections:

(A).—*Asiphonida.* Animal without siphons.

(B).—*Siphonida.* Animal possessing siphons.

A.—ASIPHONIDA. FAMILY I.—AVICULIDÆ. Shell inequivalve, oblique; umbones anterior, eared, the posterior ear wing-like; hinge with obscure teeth or none.

Genus (1).—Avicula. (Pl. xviii, fig. 601). Shell very oblique and inequivalve. The hinge has one or two small cardinal teeth. It is doubtful whether many of the Palæozoic shells which have been referred to this family, properly belong to it.

Genus (*2*).—***Ambonychia.*** (Pl. v, fig. 93). Shell oblique with nearly equal convex valves. Winged posteriorly; anterior ear nearly absent. Surface ribbed.

Genus (*3*.)—***Cardiola.*** (Pl. xiv, fig. 468). Shell oblique and equivalve with prominent beaks. Surface with radiating ribs. Hinge area short and flat. The affinity of this shell is doubtful.

Genus (*4*).—***Pterinea.*** (Pl. xviii, fig. 604). Shell resembling Avicula, but nearly equivalve; there are a few anterior radiating teeth, and elongated, oblique, posterior teeth on the long, straight hinge line.

FAMILY II.—MYTILIDÆ. Shell equivalve. Hinge without teeth. Umbones anterior.

Genus (*1*).—***Mytilus.*** (Pl. xiv, fig. 474). Shell wedge-shaped. Umbones terminal. Affinity doubtful.

Genus (*2*).—***Modiolopsis.*** (Pl. iv, fig. 88). Shell very inequilateral. Surface smooth, marked by concentric lines. Posterior end of shell much broader than anterior. The ligament which united the valves has left a groove beginning in front of the beak and extending to the posterior extremity.

Genus (*3*).—***Orthonota.*** (Pl. xviii, fig. 616, &c.) Shell elongated, equivalve but very inequilateral. Beaks close to the anterior end. Margins of shell parallel. Hinge line long and straight. Affinity of several fossils included in this genus is doubtful.

FAMILY III.—ARCADÆ. Shell equivalve. Hinge long, with many teeth.

Genus (*1*).—***Nucula.*** (Pl. xxii, fig. 767). Shell trigonal. Beaks reversed, *i.e*,, turned to the posterior and shortest side of shell. Hinge with numerous teeth. Affinity of Palæozoic Nuculæ doubtful.

Genus (*2*).—***Ctenodonta.*** (Pl. xviii, fig. 606). Posterior side usually shortest. Hinge with numerous teeth.

Genus (*3*).—***Cucullella.*** (Pl. xviii, fig. 608). Shell convex, elliptical. Beaks large, interior. Hinge line curved. There is a strong rib behind the anterior adductor impression.

B.- SIPHONIDA. FAMILY IV.—CARDIADÆ. Shell equivalve, heart-shaped with radiating ribs. Cardinal teeth two, lateral teeth one in each valve.

Genus.—***Pleurorhynchus*** (or *Conocardium*). (Pl. xiv, fig. 477). Shell very oblique, keeled. Anterior end short and truncated. Heart shaped when viewed from the front. A long, tubular, cylindrical beak at the anterior side. Hinge line long and straight. Two cardinal teeth with a hinder lateral one.

Family V.—Cyprinidæ. Shell equivalve; ligament external. Cardinal teeth one to three in each valve, and usually a posterior tooth.

Genus.—Cypricardia (*Goniophora*). (Pl. xviii, fig. 626). Shell trapezoidal, radiately striated. Hinge with three radiating cardinal teeth.

Family VI.—Anatinidæ. Shell often inequivalve, with external ligament.

Genus.—Grammysia. (Pl. xviii, fig. 625). Shell elongated. A single or double fold extends from the beak to the middle of the ventral margin.

Class IV.—Gasteropoda. The animals belonging to this class are sometimes naked, like the sea-slugs, &c., mostly however they are protected by a shelly covering: of these only the latter have left their traces in the Palæozoic rocks. Their univalve shell is not, like that of the Cephalopod, divided by septa into chambers. A muscular foot or disc, of which that of the snail is a familiar example, is formed by the ventral surface of the body and furnishes the means of locomotion. In many cases the extremity of this foot secretes a horny or calcareous plate, called an "operculum," by which the aperture of the shell can be closed when the animal withdraws into it. The Gasteropoda are nearly all unsymmetrical, the body being coiled up spirally.

A univalve shell may be described as a more or less elongated cone. That of the Limpet is an example of its simplest form. But it is usually prolonged into a tube, the mollusc being attached to and coiled round a central axis, "the columella." This is sometimes solid, sometimes hollow, in which case the shell is said to be "perforate;" and the aperture thus formed near the mouth is named the "umbilicus."

Sometimes the "whorls" or folds of the tube round the axis lie in one plane. In this case the shell is said to be "discoidal:" or they assume the form of a more or less elongated cone, termed respectively, "turreted," "turbinated," "trochoid" Univalves are divided into two important classes based upon the aperture of the shell. Those in which the mouth is entire are termed Holostomata, and those in which a notch exists in front, Siphonostremata. Through this notch the syphons pass which convey the water to and from the gills for the purpose of aërating the blood. Those gasteropoda of which their shell-apertures are entire are generally vegetable feeders, while those in which they are notched are carnivorous in their habits. The former were most numerous in Palæozoic times.

Family I.—Pyramidellidæ. *Genus.—Loxonema.* (Pl. xviii, fig. 637). Shell long and spiral (turreted), whorls convex, without spiral band. Surface covered with longitudinal sinuous lines or striae.

Family II.—Turbitellidæ. Shell tubular or spiral. Aperture simple. The genus *Holopella* (Pl. xiv, fig. 493,) is provisionally placed here.

FAMILY III.—LITTORINIDÆ. Shell spiral, top-shaped. Aperture rounded, entire. *Genus.—Holopea.* (Pl. v, fig. 95). Shell of few whorls, conical, smooth. Body-whorl expanded.

FAMILY IV.—TURBINIDÆ. Shell conical. *Genus (1).—Turbo.* (Pl. xviii, fig. 628). Whorls convex, base rounded. Apertures large and rounded. Palæozoic form of doubtful affinity.

Genus (2).—Euomphalus. (Pl. xiv, fig. 484). Shell depressed or discoidal. Whorls angulated, and aperture polygonal. Umbilicus large. *Raphistoma,* (Pl. v, fig. 94), is closely allied to this genus.

Genus (3).—Trochus. Base flat. Shell pyramidal. *Platyschisma,* (Pl. xviii, fig. 638), is allied to this genus.

FAMILY V.—HALIOTIDÆ. Shell spiral or pyramidal.

Genus (1).—Pleurotomaria. Shell very variable in shape; in some cases resembling *Trochus,* in others *Turbo,* or much flattened or depressed. Whorls few, occasionally the last disconnected from the others. Aperture, sub-quadrate, distinguished by a slit in the outer lip which, as the shell grew, became filled up, and thus a well defined band was formed along the body whorl.

Genus (2).—Murchisonia. (Pl. xiv, fig. 481). Closely allied to the preceding. The outer lip is deeply notched, and the aperture slightly channelled in front, usually more elongated than *Pleurotomaria,* and composed of a greater number of whorls, but ornamented with a similar band.

ORDER NUCLEOBRANCHIATA OR HETEROPODA. Animals which possess a vertically, instead of, as in the suail, a laterally flattened foot, terminated by a fin-like tail, with which they propel themselves and swim near the surface of the sea. They are represented in Palæozoic times by the following genera:—

Genus (1).—Bellerophon. (Pl. xiv, fig. 490). Shell symmetrical; whorls few and keeled along the convex part of the shell. Aperture generally expanded and deeply notched.

Genus (2).—Maclurea. Shell discoidal, grooved at the back, disc-shaped, left side flat, the dextral side, convex. Occurs chiefly at the base of the Lower Silurian.

Genus (3).—Cyrtolites. (Pl. xviii, fig. 639). Shell symmetrical, thin, keeled, and curved in the shape of a horn. . Whorls separate.

Genus (4).—Ecculiomphalus. Shell thin, discoidal, unsymmetrical; resembles that of *Cyrtolites,* but the whorls are few and widely separated from each other.

CLASS V.—PTEROPODA. This class is represented in the present day by two families whose habitat is far from land or oceanic. The animals are of minute size and are found in enormous numbers swimming on the surface of the sea. They propel themselves by two wing-shaped appendages, springing from the sides of the mouth, and possess a delicate glassy shell, resembling in form that of some Embryonic Cephalopods. Their ancestors in Palæozoic times were of comparatively gigantic proportions, and were represented in the Silurian era by the three following genera.

Genus (1).—Theca. (Pl. i, fig. 16). Shell bayonet-shaped or conical; usually straight, but sometimes curved, thin, transversely striated or smooth, sometimes with marginal ribs. Mouth of shell trigonal, length variable, usually from an inch to an inch and a half.

Genus (2).—Conularia. (Pl. vii, fig. 152. Shell straight, tapering towards one end, and having a rhomboidal aperture at the other; the sides composed of four plates united at their edges, and finely marked transversely with lines and dots. Conulariæ of nearly a foot in length have been found.

Genus (3).—Tentaculites. (Pl. xvii, fig. 555). This genus has been with considerable hesitation referred to the family of Pteropoda since it is doubtful whether its affinity is not rather with the Annelidea. In Mr. Etheridge's opinion they should be removed to the group Tubicolæ. The form of the shell is that of a straight conical tube, ornamented with a number of rings, the spaces between them often striated. The size varies much, being sometimes less than two lines long, sometimes an inch or more.

CLASS VI.—CEPHALOPODA. These are the most highly organised of the Mollusca. The body is symmetrical. The head is furnished with eight, ten. or more arms placed round the mouth. The viscera, which are contained in a muscular sac, in some cases enclose a horny or calcareous bone, (the pen of the Cuttle-fish), in others, are protected by an external shell, straight, or involute, which is divided into a succession of chambers by shelly septa; a membranous tube called the Siphuncle connects these chambers with each other and with the animal which occupies the last and largest, or body chamber. The shells of the Cephalopoda may be distinguished from those of the Gasteropoda by the presence of these chambers in combination with the siphuncle which the latter never possess. The respiratory organs consist of two or four pairs of plume-like gills. Those which have only two pairs of gills, (*Dibranchiata*), are not protected by an external chambered shell, while those which have four, (*Tetrabranchiata*), possess one. No traces of the former are found in rocks earlier than the secondary. The Tetrabranchiata abounded in the Palæozoic and also in the Mesozoic epochs, but are represented from the Tertiary to the present time by but one genus only, that of the Pearly Nautilus. The Dibranchiata propel themselves through the water by a jet which they have the power of emitting through the funnel, or they move along the bottom of the sea by means of their oral arms, which are furnished with suckers. The conical shell of the Cephalododa, &c., must have floated in the water with the narrow end upwards in virtue of the air supplied to it through the siphuncle.

With our scanty information about the internal structure of the Tetrabranchiata, it is not surprising that considerable diversity of opinion exists among authors as to their classification. We shall in the following sketch adopt the arrangement of Mr. Blake, who has recently published an important monograph on this class.

The Tetrabranchiata are divided into two sub-orders:—(1) NAUTILOIDEA, in which the siphuncle is variable in its position and structure, and the "sutures" or lines indicating the junction of the chambers are simple: and (2), the AMMONITIDÆ, in which the siphuncle is placed on the convex or ventral aspect of the shell, and the sutures are complex or foliated. The former alone will be mentioned here since the latter did not make their appearance until after the close of the Carboniferous period.

The *Nautiloidea* are divided into four groups.

GROUP I.—CONICI. Curvature slight or none. Form conical and regular.

Genus (1).—Orthoceras (Pl. xv, fig. 505, &c). Shell straight, conical. Siphuncle variable in position and structure. Aperture generally corresponds with the cross section, but is sometimes contracted. The surface of the shell is variously marked with striæ, longitudinal and transverse ribs, and lamellæ; of which use is made in the determination of species. Siphuncle calcareous, central, cylindrical, and dilated between the chambers.

Genus (2).—Cyrtoceras. (Pl. xv, fig. 500). Differs from the former chiefly in the curvature of the shell. Whorls disjointed, the free end being elongated, septa simple or slightly waved, siphuncle dorsal.

GROUP II.—INFLATI. *Genus (1).—Gomphoceras.* (Pl. xix, fig. 655). Form flask-shaped, or pyriform. The main axis is straight. The surface slightly marked by transverse sigmoidal striæ. Siphuncle moniliform, generally central, or if sub-central, it approaches the convex side. Septa simple; aperture contracted.

Genus (2).—Phragmoceras. (Pl. xv, fig. 498). Curvature well marked, septa simple, crossed by lines of growth; aperture contracted in the middle, with larger openings at each end, the outer extremities lapping towards each other. The surface is generally ornamented by ribs undulating across the shell. Body-chamber less inflated than in Gomphoceras. Siphuncle generally internal or ventral, moniliform between the septa.

Genus (3).—Ascoceras. (Pl. xix, fig. 670). The body chamber is inflated and gradually prolonged into a kind of neck. The surface is finely striated. The curious sigmoidal lines are a characteristic feature in this genus and indicate the septa. The earlier of these are regular, but the latter ones distorted; on the dorsal side they are distinct, on the ventral, they unite and form a single septum, but separate again. The siphuncle is excentric.

GROUP III.—SPIRALES. *Genus (1).—Nautilus.* (Pl. xix, fig. 677). Whorls in contact, shell discoidal. Siphuncle variable in its position.

GROUP IV.—IRREGULARES. *Genus (1).—Trochoceras.* (Pl. xix, fig. 675). The peculiarity of this form is its want of symmetry with regard to its principal plane which is spirally divergent; otherwise it closely resembles Lituites. Siphuncle on the convex side.

Genus (2).—Lituites. (Pl. xix, fig. 676). The earlier whorls of the shell are coiled and in contact, but the last whorl is partly free; the body chamber is straight or horizontal. Siphuncle central or sub-central.

Genus (3).—Ophidioceras. (Pl. xvi. fig. 530). Shell quite symmetrical; whorls in contact. A flat band runs along the convex side which distinguishes it from allied genera. About a quarter of a whorl or more is continued in a straight line. The aperture is trifid.

SUB-KINGDOM VI.—VERTEBRATA.

The fossil remains of vertebrate animals are seldom met with in Shropshire, and are confined, as far as is at present known, to a few species of the fishes in the Upper Silurian and old Red Sandstone, and the Reptilia and Amphibia in the succeeding strata of the Trias.

CLASS I.—PISCES (FISHES). ORDER.—GANOIDEA. The internal skeleton of the fishes classed under this order was more or less cartilaginous, but the head was furnished with distinct bones. The surface of the body is clothed with scales generally rhomboidal, (Pl. xx, fig. 698), but sometimes cycloid (Pl. xx, fig. 708), which are covered with a highly polished enamel, called ganoin, (hence the term Ganoidea for the order). The rhomboidal scales do not overlap but are joined to each other along their edges. The upper lobe of the tail extends beyond the lower, (*heteroceral*), a peculiarity which is only found in the Sturgeon and a few other fishes of the present day.

SUB-ORDER I.—CROSSPTERYGIDÆ. To this group belongs the genus *Holoptychius* of which some traces have been found in the old Red Sandstone near Ludlow. (Pl. xx, fig. 708.

SUB-ORDER II.—OSTEOSTRACI. The fishes of this division, commonly known as *Placodei*, have the head and anterior parts of the body covered with ganoid plates which encase them like armour.

FAMILY CEPHALASPIDÆ. SECTION A.—HETEROSTRACI. Structure of the head or cephalie shield consists of 1st, an inner shell-like or "nacreous layer;" 2nd, a stratum of polygonal cavities, and 3rd, the surface is covered by a series of minute ridges, and not by tubercles as in the next section.

Genus (1).—Scaphaspis. Shield in one piece; oval. (Pl. xxii, fig. 808).

Genus (2).—Cyathaspis. Shield in four divisions; oval. (Pl. xxii, fig. 809.)

Genus (3).—Pteraspis. Shield in seven divisions; sagittiform. (Pl. xxii, fig. 810).

SECTION B.—OSTEOSTRACI. The shield is here also composed of three layers, but the inner one has a laminated texture, and is traversed by numerous lacunæ or canals; in the next a fine tubular network takes the place of the canals, and the lamination is less distinct than in the deeper layer, and lastly, the surface is ornamented with tubercles.

Genus (1).—Cephalaspis. (Pl. xxii, fig. 811). Shield in one piece, semicircular, and prolonged at each side into spines or horns, (posterior cornu).

Genus (2).—Auchenaspis. (Pl. xxii, fig. 812). Shield divided into an anterior and posterior portion, of which the anterior is larger and prolonged into horns or spines.

Genus (3).—Didymaspis. (Pl xxii, fig. 813). Shield divided into anterior and posterior parts, of which the anterior is the smaller and without horns.

Allied to the preceeding is the genus *Pterichthys* of which specimens have been found in the upper beds of old Red Sandstone to the north of the Clee Hills, (Pl. xxii, figs. 814, 815). The entire head and anterior part of the body is covered with large plates, articulated together; the rest, with small ganoid scales. The pectoral fins, in the form of curved spines somewhat like wings, are peculiar to this genus.

To a sub-order of Plagiostomous fishes may possibly be referred the spines of Onchus, which abound in the Ludlow Bone-bed. This sub-order includes the modern sharks and rays. It is however quite possible that the spine defences may have belonged to Pteraspis or the telsons of Pterygoti, with numerous fragments of which they are often associated.

CLASS II.—AMPHIBIA. ORDER I.—LABYRINTHODONTIA. To this order is referred the fine specimen of which a figure is given, (Pl. xxi, fig. 722). The *Loxomma* possesses a vaulted, triangular skull, with large posterior expansions. Eyes large. Teeth unequal, clustered, having large anterior and posterior cutting edges.

CLASS III.—REPTILIA. To this class may be provisionally referred the *Rhynchosaurus* (Pl. xxi, figs. 723-4 and 766), although Palæontologists are not agreed as to its true affinities. Its vertebræ are concave at both ends, and the jaws exhibit no traces of teeth. The upper is prolonged into a powerful beak.

DESCRIPTION OF PLATES.

Note. *The numbers which follow the specific name indicate the relative size of the figures to that of the specimens.*

PLATE I.

Fig. 1.—*Arenicola didyma.* Elongated, generally parallel impressions, probably formed by a worm or Annelid similar to the Lobworm of the present day. Occasionally the trails of the worms may be found. Mr. Salter supposes that their elongated form is due to the effect of currents.

Fig. 2.—A. *sparsus,* about ½ a line broad; in pairs from a line to ¼ inch apart; occurring in myriads on the finer shales, especially the red ones, and sandstones, the smaller close together. They are often found only in the hollows of rippled surfaces, the current having erased them from the more elevated portions. They appear to be distinct from the preceeding, the holes being more remote and not elongated, they are moreover higher up in the series, Yearling Hill, The Ashes Valley, The Packet stone, Light Spout, Longmynd.

Fig. 3.—*Dictyomena sociale.* Named previously by Eichwald, *Dictyograptus flabelliformis.* Fronds often 3 inches long, cup-shaped and conical; a closely set double row of corneous cells, like those of graptolites projects on each side of the branches. Abundant at Pedwardine; also found at Shineton.

Fig. 4.—*Macrocystella Mariæ.* Apparently allied to the Crinoida. Shineton.

Fig. 5.—*Agnostus dux.* Glabella divided transversely by a straight line, in this respect resembling the Menevian species. Sometimes half an inch long. Shineton.

Fig. 6.—*Olenus triarthrus,* 3½. Thorax of 15 (or more) rings or somites. tail of 2 or 3; glabella more square, spines longer, axis narrower, and rings more numerous than in *O. Salteri.* Shineton.

Fig. 7.—*Olenus Salteri,* 2. Thorax of 11 (or more) rings, each with a tubercle; tail 2 or 3 segments. Shineton.

Fig. 8.—*Conophrys Salopiensis,* 7. ¼ of an inch long. Thorax 6, tail or Pygidium, 4 segments. Distinguished by the peculiar form of its glabella. Shineton.

Fig. 9.—*Conocoryphe* (*Euloma,* Linn. Bröngn.) *monile,* 2. Thorax 13 rings; tail small, entire. Axis reaches nearly to the margin. Shineton.

Fig. 10.—*Asaphus Homfrayi.* Labrum not forked, as in the Asaphi, hence Dr. Callaway proposes the subgeneric name *Asaphellus.* Otherwise closely like *A. Homfrayi.* Shineton.

Fig. 11.—*A.* (*Platypeltis*) *Croftii,* 1½. According to Bröngn a species probably of the genus *Symphysurus.* Distinguished by its large eyes and unforked labrum. Shineton, Mary Dingle, near Garmstone.

Fig. 12 —*Lichapyge cuspidata,* 8. Figured from a unique specimen.

Fig. 13.—*Obolella Sabrinæ,* 5. Closely resembles the Menevian *O. Sagittalis,* but is broader and the ventral valve is more conical. Shineton, Mary Dingle, Cressage, W. of Harley, Cound Moor.

Fig. 14.—*Lingulella Nicholsoni.* Length 5, width 3½ lines. Found in the same places as the preceeding, as also at Pedwardine.

Fig. 15.—*Bellerophon Shinetonensis.* Greatest diameter 7 lines. Rare.

Fig. 16.—*Theca lineata.* Length about ⅜ inch. Longitudinally striated. Shineton. Not rare. For *Bryograptus Callavei,* a Tremadoc form see Pl. xxii, fig. 800.

Fig 17.—*Didymograptus geminus.* Branches slender, hydrothicæ 20-25 to the inch; inclined to the axis at an angle of 30 deg. to 35 deg.; denticles pointed sub-mucronate.

Fig. 18.—*Scolithus linearis.* The filled-up, looped burrows of *Arenicola;* from a line to an inch in diameter. Stiperstones; abundant also in the Potsdam sandstones, N. America. Hall.

Fig. 19.—*Trinucleus Murchisoni.* Salt. About ½ inch long. Resmebles *T. fimbriatus,* from which it differs in having only 2 or 3 short curved ribs instead of about 5 straight ones, a longer tail and the surface of the lobes of the head granular, not pitted. Cefyn Gwynlle, Shelve.

Fig. 20.—*Æglina binodosa.* Glabella fringed by the enormously developed compound eyes. Two tubercles on the third body ring Meadow town.

Fig. 21.—*Ogygia Selwynii.* Thorax of 8 narrow, well defined segments. Axis not quite ⅔ the width of the pleuræ; pleural groove very shallow; margin of tail broad, flat or slightly concave. Common form in the neighbourhood of the Stiperstones,

Fig. 22.—*Calymene parvifrons.* Width of head more than twice its breadth. Cheeks large and tumid; eyes on the upper lobe of glabella. Mytton Dingle.

Fig. 23.—*Obolella plumbea.* Genus not quite certain. Surface smooth, marked with many concentric lines crossed by fine radiating striæ. Length 8 lines, width 8 to 10 lines. Abundant W. of Stiperstones.

PLATE. II.

Fig. 24.—*Rodonia* (*Cuculella ?*) *anglica.* Ritton Castle.

Fig. 25.—*Theca simplex.* 1¼ inches long; dorsal surface plain; ventral, highly convex, with a few longitudinal lines crossed by lines of growth; longer in shape than *T. Forbesii.* White-Grit Mine, Shelve.

Fig. 26.—*Orthoceras Avelini.* Imbrications seen on some specimens. Cefn Gwynelle, Shelve, Bog Mine, and see also Pl. xxi, fig. 761.

Fig. 27.—*O. encrinale.* *O. perannulatum* (Portlock), which latter name is adopted by Blake. The number and strength of the ribs are the chief features of this species.

Fig. 28 —Possibly *Didymograptus Murchisoni*, a robust species; hydrothecæ 20-25 to the inch, at an angle of 45 deg. to the axis with spinose denticles.

Fig. 29.—*Diplograptus foliaceus.* Very variable in character. From 1 to 3 inches long. The proximal or tapering extremity is furnished with a radial and two spurs. Virgula much prolonged at the other or distal extremity. Thecæ making a very small angle with the axis.

Fig. 30.—*Dictyonema sociale.* See fig. 3.

Fig. 31.—*Agnostus Macoyi.* Minute, not ⅛ inch long; head and tail nearly the same shape, the latter a little more oblong; segments unknown. Shelve, Marrington, abundant near Builth.

Fig. 32.—*Trinucleus Lloydii.* Pores of cephalic fringe ranged radiately. The great size and pendant form of the head-wings distinguish the species from *T. concentricus.* Thorax 6 segments. Linley, &c.

Fig. 33.—*Trinucleus Gibbsii.* Body of 6 flat segments; fringe narrow, radiately punctate.

Fig. 34.—*Ampyx Salteri.* The wide margin of tail and very broad glabella distinguish this species.

Fig. 35.—*Ampyx nudus.* Head semi-circular; frontal spine short; angles extended into long spines; segments of Thorax 6; tail triangular with 8-9 furrows.

Fig. 36.—*Illænus perovalis.* 2½ inches long, by 2 inches broad; axis well marked; glabella narrow. Should be searched for between Corndon Hill and Hope Mill, and at Shelve.

Fig. 37.—*Æglina mirabilis* Thorax 5 or 6 segments. Figured from a fine specimen found near the west gate of Linley Hall.

Fig. 38.—*Asaphus tyrannus.* Thorax 8 segments. Labrum deeply forked (fig. 38a). Specimens sometimes attain a length of nearly a foot. Meadowtown, &c.

Fig. 39.—*Ogygia Buchii.* Length sometimes 7, generally 3-4 inches. Axis of the tail more tapering than is represented in the figure.

Fig. 40.—*Calymene Cambrensis.* From a specimen in the Ludlow Museum. The front of the head is represented rather too flat and recurved. Axis is narrow compared with the width of the pleuræ. West gate, Linley Hall.

Fig. 41.—*Cheirurus Sedgwickii.* From a specimen in the Ludlow Museum found near the west gate of Linley. Thorax 12, tail 3 segments; tail broad and terminating in 6 leaf-like flaps.

Fig. 42.—*Lingula attenuata.* Beaks sharply acuminate; front much rounded; surface with concentric lines of growth. Length 9, width 6½ lines, usually smaller.

Fig. 43.—*L. granulata.* Transversely as well as radiately striate, hence its reticulate appearance. Shell always very black. Length of large specimens 12, width 8 lines.

Fig. 44.—*Euomphalus Corndensis,* 2. Leigh Hall, Corndon.

Fig. 46.—*Bellerophon perturbatus.* (*Euomphalus furcatus.* Mc. Coy.) Discoid, with 3-4 rounded whorls; surface crossed by numerous, fine, rounded ridges.

Fig. 47.—*Crytoceras multicameratum.* Remarkable for the close approximation of the septa.

The following list of graptolites from the Arenig formation has been furnished by Mr. Hopkinson :—

RHABDOPHORA. *Didymograptus affinis,* Ritton Castle. *D. bifidus,* Ritton Castle, Ladywell Mine. *D. constrictus,* Shelve, Snailbeach. *D. Nicholsoni,* Ritton Castle. *D. patulus,* Shelve, Stiperstones, Ritton Castle, Ladywell Mine. *D. pennatulus,* Stiperstones. *D. sparsus,* Shelve. *Tetragraptus Halli,* Shelve. *T. quadribrachiatus,* Stiperstones. *Clematograptus implicatus,* Shelve. *Phyllograptus sp.,* Bog Mine. *Diplograptus dentatus. Climacograptus confertus. Trigonograptus truncatus,* Bog Mine.

CLADOPHORA. *Dictyograptus sp.* (*? Homfrayi*), fig. 30; *Callograptus elegans*; *C. Salteri*; *Dendrograptus diffusus*; *D. flexuosus*; *Ptilograptus* (*? plumosus*); all from Shelve Church.

PLATE III.

Fig. 48.—*Sphærospongia hospitalis.* A genus widely diffused in Europe and Asia. Of doubtful affinity; possibly allied to the Cystoidea.

Fig. 49.—*Diplograptus pristis.* Referred by Hopkinson to *D. foliaceus,* see Pl. ii, fig. 29. Arenig to Caradoc.

Fig. 50.—*Monticulipora favulosa.* This coral is now classed among the *Alcyonarians,* its imperforate walls indicating more affinity with them than with the *Actinozoa.* Tabulæ are present. Llandeilo to Caradoc.

Fig. 53.—*Tentaculites anglicus.* Straight, unattached worm-tubes, resembling certain horny, Mediterranean species. In Nicholson's opinion they belong to the *Pteropods.* Llandovery to Caradoc.

Fig. 54.—*Beyrichia complicata.* Surface of valve depressed, having 3 sharply defined ridges, with a connecting ridge along the ventral margin; anterior, largest, pear-shaped; middle, narrow, club-shaped; posterior, with transverse depression which sometimes bifurcates the ridge. A bivalve crustacean. Llandeilo to Caradoc.

Fig 55.—*Trinucleus concentricus.* Distinguished by its simple fringe, the pores not being sunk in a furrow as in *T. fimbriatus,* or enlarged at the outer angles as in *T. favus,* or concave as in *T. Lloydii.* Llandeilo to Caradoc.

Fig. 56.—*Ampyx pennatus.* Salt. m s. Undescribed.

Fig. 57.—*Remopleurides sp.* Several fragments have been found at the Onny section near Longville.

Fig 58.—*Illænus Davisii.* Seldom more than 2¼ inches long. Thorax 10 segments; eyes more approximate than in *Il. Bowmanni.*

Fig 59.—*Asaphus Powysii.* Sometimes 6 inches long. Thorax 8-9 rings. Tail resembles that of *Homalonotus bisulcatus* Distinguished from *A. tyrannus* by the absence of the lobes of the glabella and its more tapering axis. Llandeilo to Caradoc.

Fig. 60 —*Cybele verrucosa.* Cephalic shield coarsely tuberculated; glabella clavate, convex, front obtusely rounded; segments of thorax narrow, those of the axis terminating in a tubercle at each end; pygidium sub-rhomboidal. Length of head about 7 lines, of pygidium, 9 lines. Llandeilo to Caradoc.

Fig. 61.—*Calymene Caractici* A variety of *C. Blumenbachii.* The glabella is smaller in proportion and the side ribs of the tail more arched.

Fig. 62.—*Homalonotus bisulcatus.* Glabella without lobes. Trilobation distinct but not deep; head blunt, semi-ovate; tail round; sometimes attained a length of 10 inches. Caradoc to Llandovery.

Fig. 63.—*Lichas laxatus.* This species is marked by having the margin of the cephalic thorax in one plane, the front not being bent over. A common Irish species. Acton Scott. Caradoc to Llandovery.

Fig. 64.—*Acidaspis Caractici.* Glabella triangular, wide, bilobed on both sides; pleuræ with deflexed spines.

Fig. 65.—*Phacops conicophthalmus.* About 17 or 18 segments; head only as long as it is broad, differing in this respect from the following :—

Fig. 66.—*P. macroura.* 16 segments; head spines longer, eyes larger, and cheeks narrower than in the preceding species; otherwise very similar.

Fig. 67.—*P. apiculatus.* Resembles *P. Downingiæ,* but is smaller; distinguished by the faint upper lobes of the glabella and the mucronate tail. Llandeilo to Caradoc.

Fig. 68.—*Fenestella.* Belongs to the class Polyzoa; resembles in some points *Dictyonema* but is removed from the Hydrozoa by (1), its structure, which is calcareous rather than corneous; (2), the presence of a vertical fibrous layer on the reverse side, and (3), cells are not found on the cross bars.

Fig. 69.—Possibly a Polyzoon.

The following Graptolites are also mentioned by Mr. Hopkinson—*Didymograptus Murchisoni*, Meadowtown, Cefn Gwynlle. *Diplograptus dentatus*, *Climacograptus Scharenbergii*, Meadowtown. *Lasiograptus retusus*, Meadowtown.

NOTE.—The fossils in this plate which are reported from Shelve should be referred to Arenig.

PLATE IV.

Fig. 70.—*Lingula tenuigranulata.* Granular structure of the surface very minute, invisible without a lens. Length 19-22, width 15-14 lines.

Fig. 71.—*Trematis sp.* Dr. Davidson considers that sufficient is not known of the genera *Trematis* and *Discina* to warrant their separation.

Fig. 72.—*Discina punctata* Surface covered with a net-work of hexagonal cells. A fine specimen is figured by Dr. Davidson. Lower valve with an oval slit. Length 7, width 7½ lines.

Fig. 73.—*Leptæna sericea.* Differs from *L. transversalis* by its smaller beak, more transverse form, coarser striæ, and finer punctures; muscular impressions also more expanded. Length 5, width 9 lines. Llandeilo to Llandovery.

Fig. 74.—*Strophomena grandis.* Distinguished from *S. expansa* and *S. compressa* chiefly by the dorsal valve being convex, and the ventral concave. The muscular impressions are also much narrower. Length 22, width 27 lines.

Fig. 75.—*S. expansa* Separated by Dr. Davidson from the genus *Orthis*, under which it had been described, from its concavo-convex form, fissure closed with pseudo-deltidium, bifid cardinal process, and the position and shape of its muscular scars. Length 26, width 30 lines. Llandovery to Caradoc.

Fig 76.—*S. (Leptæna) tenuistriata.* Probably a variety of *S. rhomboidalis.* Interspaces between the strong striæ well marked, and filled by one or two smaller ribs.

Fig. 77.—*Orthis testudinaria.* Ventral valve moderately convex, dorsal, very slightly so; surface covered with coarser and more unequal ribs than in *O. elegantula.* Length from 7 to 11, width from 7 to 12 lines. Llandeilo to Llandovery.

Fig. 78.—*O. elegantula.* Oval. Ventral valve convex, without sinus; dorsal flat, with slight sinus. Surface marked with fine striæ. Length 9, width 8 lines. See also Pl. xxii, figs. 793-7. Llandeilo to Ludlow.

Fig. 79.—*O. biforata.* Very variable as to number of plaits and form. Ventral valve with wide deep sinus; dorsal, deep, one to five ribs in the sinus. Length 11, width 13 lines. Llandeilo (?) to Wenlock.

Fig. 80.—*O. flabellulum.* Ventral valve flatter, and dorsal deeper than in *O. Calligramma.* The ribs sometimes fork once or twice, are variable in number, with concave interspaces in which a smaller rib is interpolated. Length 12, breadth 15 lines. See also Pl. xxii, fig. 779.

Fig. 81.—*O. calligramma.* Differs from the preceding in having the ventral valve deep, and the dorsal flat; ribs simple, rounded, without interpolated ribs though fine striæ are present. Length 10-13, width 10-15 lines. See Pl. xxii, fig. 769-74. Llandeilo (?) to Wenlock.

Fig. 82.—*O. porcata.* Ventral valve convex near the beak, concave along the middle; dorsal evenly convex; ribs fine, radiating, increasing in number towards the margin. Length 15, width 15-20 lines.

Fig. 83.—*O. triangularis.* Figured from Murchison's Siluria. A doubtful form.

Fig. 84.—*O. unguis.* Ventral valve convex, slightly keeled; beak incurved; dorsal valve very slightly convex, depressed along the middle. Length 6, width 6½ lines.

Fig. 85.—*O. vespertilio.* Dorsal valve convex, divided into two lobes by a deep sinus; ventral valve convex at the beak, slightly concave in front. Surface striated with ribs arranged sometimes in clusters of 4 or 5. Length 15, width 19 lines. Llandovery to Caradoc.

Fig. 86.—*O. Actoniæ.* Ventral valve convex, ; dorsal, flat or slightly concave, resembling in this respect the genus *Strophomena.* Ribs variable, often divided near the margin into clusters of 2 or 3. Distinguished from *O. flabellulum* by the relative convexity and concavity of the valves. Length 12, width 17 lines. Llandeilo to Llandovery.

Fig. 87.—*O. alternata.* Hinge line not so broad as the shell; ventral valve gently convex; dorsal nearly flat; both valves finely, radiately striated, with concentric lines crossing the striæ. Fragments often mistaken for *Strophomena expansa* or *Leptæna sericea.*

Fig. 88.—*Modiolopsis orbicularis.* Shell oblong; umbones anterior; hinge toothless.

Fig. 89.—*M. obliqua.* Shape trapezoidal; the umbonal ridge distinct, prominent, rounded.

Fig. 90.—*M. modiolaris.* Shell gradually widening to its posterior end; about 2½ to 3 times longer than wide. A narrow sinus in the anterior part of the ventral margin, from which a slight hollow extends towards the beak. Surface with concentric lines and waves of growth. Length more than 2 inches.

PLATE V.

Fig. 91.—*Orthonota (Modiolopsis) postlineata.* Frequent in Caradoc rocks of N. Wales. Twice as long as wide; beaks small, near the anterior end. Dorsal and ventral margins nearly parallel, straight. Length 1 inch.

Figs. 93-4.—Species undescribed.

Fig. 95.—*Holopea striatella, (Trochus constrictus* McCoy). Conical; whorls 4—5, increasing, each with a shallow concavity below the suture; base flattened; surface marked with oblique, fine lines of growth. Length 8 lines. Horderley.

Fig. 96.—*Murchisonia gyrogonia.* Acutely conical; whorls 3½; keel acute; body whorl with an additional fine keel. Surface finely striated. Length 4½ lines.

Fig. 97.—*Pleurotomaria latifasciata.* Conical; whorls 4, slightly convex, having a very broad, flat, submesial band. Length 2 lines, width the same.

Fig. 98.—*Bellerophon acutus.* Lenticular; greatest thickness at the edges of the umbilicus, which is very small; circumference acutely angulated; mouth triangular. Identical, according to McCoy, with *B. carinatus.* Horderley.

Fig. 99.—*B. bilobatus.* In well-preserved specimens, a wide flat band with arched striæ (leaving no trace on the interior), extending from the sinus, may be detected. Surface marked with flexuous, coarse striæ. Horderley, Cheney Longville, Soudley, &c. Llandeilo to Caradoc.

Fig. 100.—*B. nodosus.* Spire of about three rapidly increasing whorls; sides marked by thick raised ridges; lines of growth beautifully regular, forming reticulations on the umbilical face. Hope Bowdler.

Fig. 101.—*B. sulcatinus.* Described by Prof. Hall, Pal., N. York, vol. 1., p. 32. Surface marked with longitudinal ridges, crossed by transverse lines which make a retral angle on the depressed dorsal line. Readily distinguished by the beautifully ornamented surface, absence of dorsal carina, and the acutely angular edges of the inner whorls.

Fig. 102.—*Theca reversa.* Resembles *T. Forbesii* of the Upp. Silurian in shape and size, but differs in having the dorsal plate convex. Horderley. Llandeilo to Caradoc.

Mr. Hopkinson reports the following graptolite from Soudley, *Climacograptus* (? *Wilsoni.*)

Fig. 103.—*Petraia elongata.* Average diameter ¾ inch; lamellæ 32—36, extending nearly to the centre; between each pair of primary lamellæ there is a finer secondary one, pierced with papillæ. The pitting of these, and the greater size and number of the lamellæ, distinguish this form from the following:—

Fig. 104.—*P. subduplicata.* Rarely found below the Llandovery rocks. Average length ¾ inch, width 7 lines, 27 to 28 primary, alternating with as many secondary sulci. Norbury. Caradoc to Llandovery.

Fig. 105.—*P. subduplicata,* var. *crenulata.* Distinguished from the preceding in having the primary and secondary lamellæ bent into numerous zig-zag flexures.

Fig. 106.—*P. bina.* Adult length ¾ inch, width ½ inch. Slightly curved towards the apex. Lamellæ consist of from 30 to 40 rows of conical papillæ, extending but a short way towards the centre, and between these are an equal number of secondary rows of papillæ. Stoke Wood. Llandovery to L. Ludlow.

Fig. 108.—*Cornulites serpularius.* The joints are continuous in substance, forming a rigid tube. The internal cast is different from the external form, as in *Tentaculites.* Surface obscurely marked with fine longitudinal striæ; tube much bent at smaller end, sometimes 3 inches long. Affinity doubtful, as is that of *Tentaculites.* Onibury. Llandovery to U. Ludlow.

Fig. 109.—*Illænus æmulus.* Known from a caudal shield in Mr. W. Edgell's collection, found at Norbury ; described by Salter as intermediate in character between *Il. Bowmanni* and *Il. Thompsoni.*

Fig 110.—*Illænus Bowmanni.* Frequently 4 inches long. Extremities very convex. Head not much larger than tail. Thorax scarcely more than half the length of head. Eyes small and remote. Axis of thorax wider than the pleuræ. Llandeilo to Wenlock.

Fig. 111.—*Illænus Barriensis.* Abundant and of wide range. Attains 6 inches by three and a half in size. Form, broad oval. Tail as long as head. Body (of 10 arched segments), longer than either. Trilobation extremely faint, though the oval furrows are strongly marked for a short distance in the head. Llandovery to Wenlock.

Fig. 112.—*Illænus Thompsoni.* Closely resembles *Il. Bowmanni,* but more bulky; not so common. Trilobation more marked, and axis of thorax more tapering ; tail also longer in proportion to its width. Eyes more forward. Size, not less than 6 inches by 3¼. Confined to the Llandovery rocks. Llandovery to Wenlock.

PLATE VI.

Fig. 113.—*Cheirurus bimucronatus.* Furrows run partly across the glabella, which is broad in front. Cheeks narrower than the glabella. Tail narrower than the thorax, the 3 pleuræ of which terminate in points on each side, but sometimes a short mucro occupies the centre space. Onny. Caradoc to Aymestry Limestone.

Fig. 114-5—*Encrinurus punctatus.* All the segments of the thorax are of equal length and are not produced into spines. There is no rostral shield, but a vertical suture separates the cheeks in front. Thorax segments 11. Llandovery to Ludlow.

Fig. 116.—*Phacops Stokesii.* Not found in the lower Silurian rocks. From an inch to an inch and a half long. Head semi-circular, wider than thorax, the axis of which is narrow. Tail semi-circular, with a blunt point, marked with five or six segments. Llandovery to Ludlow.

Fig. 117.—*Leptæna transversalis.* A variable shell, considerably more globose than *L. sericea* from which it also differs in its muscular impressions. Length 9, width 11 lines. See also Pl. xxii., figs. 780—3. Caradoc to Wenlock.

For *L. scissa* see Pl. xxi, figs. 730-2.

Fig. 119.—*Orthis biloba.* Dorsal valve moderately convex ; ventral still more so. Varies much in the degree of lobation. It has a wide geographical range. Length 7, width 5 lines. Onny. Caradoc to Ludlow.

Fig. 120.—Read *Strophomena rhomboidalis.* For description see Pl. xiii, fig. 390.

Fig. 121.—*S. compressa.* Closely resembling *S. expansa,* and possibly a descendant of that species ; it is, however, smaller, and the concentric waves of growth, thread-like striæ, large punctures, and more compressed valves distinguish it from the latter. Length 14, width 19 lines. Horderley, Norbury, Chirbury. Caradoc to Llandovery.

Fig. 122.—*S. antiquata.* Hinge line nearly or quite as long as the shell is wide. Sculpture consists of coarse, thread-like, often waving radii, crossed by strong, scaly, prominent ridges or imbricated lines of growth. Variable ; length 14, width 19 lines. See also Pl. xxi., fig. 733. Benthall Edge, Minsterley. Caradoc (?) Llandovery to Wenlock.

Fig. 123.—*S. pecten.* Valves much compressed ; covered with numerous, nearly equal ribs, increasing rapidly in number as they approach the margin, crossed by many concentric lines of growth. Length of very large specimen 23, width 40 lines. Benthall Edge, Minsterley. Llandovery to Wenlock.

Fig. 124.—*Orthis calligramma ; var. Davidsoni.* Differs from *O. calligramma* in having the beak inclining backwards instead of being incurved. Ribs vary from 16 to 19. and the concentric equidistant striæ are conspicuous. Minsterley. Caradoc to Wenlock.

For *O. (Triplesia), insularis,* see Pl, xxi, fig. 727.

Fig. 125.—*Pentamerus oblongus.* Extremely variable in form. Surface smooth, with a few irregular concentric furrows. Septum of ventral valve ⅔ rds. or more of its length. In dorsal valve two similar, long septa, corresponding with the V-shaped cavity of the opposite valve. Beak so much incurved as to touch the umbone of dorsal valve. Ventral valve much the largest. Length 31, width 27—32 lines. Norbury. See also figs. 134 and 139.

Fig. 126.—*P. oblongus, var. lævis.* Supposed to be the young of *P. oblongus.*

Fig. 127-28.—*P. undatus.* Much wider than long. Surface smooth, only marked by concentric lines. Chamber in the interior of ventral valve small, as well as the internal plates or septa. Mr. Salter thinks that this species as well as *P globosus* may belong to the genus *Stricklandinia.* Length 7-11, width 10-16 lines. Church Stretton. Fig. 127, aspect from the front, showing the deep depression or sinus in the ventral and corresponding fold of the dorsal valve. Fig. 128, ventral valve, showing the much incurved beak. Specimens are sometimes found with a short slit in this valve indicating the septum which supports the small chamber within.

Fig. 129.—*P. globosus.* Circular or only slightly transverse-oval; globose. Ventral valve with a long slit indicating the septum. Surface marked by irregular obscure ridges. The figures represent internal casts. Length 6, width 7 lines. Onny.

Fig. 130.—*Atrypa hemispharica.* Ventral valve convex, dorsal nearly flat, each ornamented with from 12-18 rounded ribs. There exists some doubt whether this shell properly belongs to the genus *Atrypa.* Length 5, width 6 lines.

Fig. 131.—*Pentamerus oblongus.* Side view, showing the beak of the ventral valve nearly touching the umbone of the dorsal.

Fig. 132.—Read *Stricklandinia (Pentamerus) lirata.* Hinge line nearly straight and shorter than the width of the shell; valves nearly equally convex; dorsal trilobed; sinus in ventral valve; surface ornamented with ribs which bifurcate, and with concentric lines. The very short septum in the ventral valve supports a small wide triangular chamber. Length 28-16, width 29-16 lines. N. E. of Chirbury. Llandovery to Wenlock.

Fig. 133.—Read *Stricklandinia* (*Pentamerus*) *lens.* This genus differs from the former in having nearly equal valves, and not possessing the two septa in the dorsal valve and the triangular chamber within, which distinguish *Pentamerus.* Its form is oval, heart-shaped, or globose. Length 31-21, width 25-19 lines. Norbury, Minsterley.

Fig. 134.—*P. oblongus.* Ventral valve, showing long vertical median septum which supports the plates forming the central V-shaped cavity.

Fig. 135-6.—*Atrypa reticularis.* One of the most abundant shells in the Ludlow and Wenlock rocks of England. Dorsal valve convex and gibbous; ventral slightly concave with a sinus towards the margin. Surface covered with numerous radiating, bifurcated ribs. Valve crossed at irregular intervals by "foliated expansions" which project from two lines to nearly an inch from the surface. For interior structure see Pl. xxi. fig. 748. Length 26, width 21 lines. Fig. 136, found near Craven Arms. Llandovery to Ludlow.

Fig. 137-8.—*Rhynchonella furcata* Left, provisionally, by Dr. Davidson in the genus *Meristella,* in which it had been placed by Mr. Salter. Marked by the branched furrows which appear in relief on the casts. Found a mile and a half south of the Bogmine, Shelve; and at Morrell's Wood near the Wrekin, more information concerning this species is desirable. Length 4¼. width 4 lines.

Fig. 139.—*Pentamerus oblongus.* Dorsal valve, shewing the position of the two vertical septa supporting two outwardly sloping plates, which correspond with those that form the V-shaped chamber of the opposite valve. Norbury, &c.

Fig. 140.—Read *Spirifer plicatellus,* var. *radiatus.* Incorrectly inserted here. See Pl. xiii, fig. 427.

Fig. 141.—*Rhynchonella decemplicata.* Length 7-5, width 7-6 lines. Valves convex; ventral, with a wide sinus and a small median rib; dorsal, divided by a wide biplicated fold, on each side of which there are from 5 to 7 ribs; these are not therefore, as the name would imply, confined in number to ten. It appears to be a form peculiar to the Upper Llandovery rocks. Chirbury, Norbury, Onny.

Fig. 142.—*R. neglecta.* Figured from an imperfect specimen which is supposed by Dr. Davidson to belong probably to the following:—

Fig. 143-5.—*R. nucula.* Shell sub-pentagonal. Ventral valve less convex than dorsal. The latter has a mesial fold, much raised in front. Ribs angular; from sixteen to twenty in number, of which usually four occupy the fold, and three the corresponding sinus, a shell of wide range from the Lower Llandovery to the Upper Ludlow formations. Length 5-6, width 6 lines. Fig. 144, side view shewing the small, pointed, incurved beak. Fig. 145, view of dorsal valve, in which, however, the character of the mesial fold is not sufficiently represented. See also Pl. xxii, figs. 790-2. Llandovery to Ludlow.

For *R. Llandoveriana* see Pl. xxi, figs. 728-9.

PLATE VII.

Fig. 146.—Drawn from figures in Murchison's Siluria. A variety of *A. reticularis.* (a) Ventral valve, (b) Dorsal valve. Both are casts of interior.

Fig. 147.—*Orthis reversa.* Round. Hinge line very short. Ventral valve evenly convex, dorsal, with a shallow sinus near the front. Beak small, incurved. Surface covered with radiating striæ. Length 9-10, width 9-12 lines. Llandovery. Not reported from Shropshire.

Fig. 148.—*Holopella cancellata.* Whorls traversed with about 5 delicate spiral threads, crossed by fine close striæ of growth. Width about 3 lines. Caradoc to Ludlow.

Fig. 149.—*H. obsoleta.* Whorls about 8-9. Surface crossed by very fine slightly sigmoid striæ. Length 1⅛ inch. Llandovery to Ludlow.

Fig. 150.—*Bellerophon trilobatus.* Globose; umbilicus small; whorls trilobed by two deep spiral furrows; mesial lobe most prominent. Width and length, ¼ inch. Llandovery to Ludlow.

Fig. 151.—*Raphistoma (Pleurotomaria,) lenticularis.* Whorls only slightly convex; a small sharp keel encircles the body whorl, above it a band, scarcely visible; surface smooth, under the lens marked with minute striæ. Diameter 1½ inches. Green Quarry, Leintwardine.

Fig. 152.—*Conularia Sowerbii.* The graceful bend of the crenated ridges across the face of each side distinguishes this beautiful and common shell. The section is rhomboidal. Figured from a fine specimen in the Ludlow Museum, which well shows the form of the valves at the larger end. Acton Scott. Caradoc to Ludlow.

Fig. 153.—*Euomphalus sculptus.* Discoid. Whorls about 3, slightly elevated; mouth nearly circular; umbilicus very wide; surface covered with numerous smooth, very close cord-like ridges, unequal in size. Diameter about 1¼ inches. Separated from *E. funatus* by the absence of the transverse, scale-like sculpturing, and the more numerous ridges. Caradoc to Ludlow.

Fig. 154.—*Cnemidium tenue,* 2. The section exhibits numerous canals radiating from a comparatively large central space. Dudley.

Fig. 155-6.—*Acervularia ananas.* Corallum massive. Corallites sometimes free, but generally united by their walls, and prismatic. Septa from 54 to 30. Breadth from 6 to 2 lines. Distinguished from other species of the same genus by the developement of its inner walls, and its almost exclusively calycinal mode of gemmation. Fig. 156, section of the same. Wenlock.

Fig. 157.—*Syringopora serpens.* In old specimens the corallites become very tall and closely set. Walls thick; 18 septal striæ. Diameter somewhat more than ½ line. Differs from others of the same genus by the large size and the irregularity of the corallites, and the extreme rarity of the connecting tubes. Benthall Edge. Llandovery to Wenlock.

Fig. 158.—*S. fascicularis.* When young this coral resembles *Aulopora* in its short prominent calicular tubes, these multiply afterwards by lateral gemmation and become tall and crowded. Diameter of corallites about ⅓ of a line, geminating frequently. Walls very thick, with strong epitheca. Benthall Edge. Llandovery to Wenlock.

Fig. 159.—*S. consimilis,* 2, and Fig. 160 *Favosites oculatus* probably both belong to the class Bryozoa.

Fig. 161.—*Stromatopora striatella* (? a calcareous sponge). Corallum forms large amorphous masses, consisting of layers of cells, occasionally marked on the upper surface with obscure pits arranged in quincunx form. There are no radiating lamellæ. Caradoc to Wenlock.

Fig. 162-4.—*Arachnophyllum (Strombodes) typus.* Corallum composite, massive; corallites separated from each other by strong polygonal ridges, near the centre of each a slight circular elevation indicates the summit of the inner wall; septa, which at the outer edge of the coralite number about 100, are fewer by ⅔rds. when they reach the centre. Horizontal section shows that the septa are crossed by delicate dissepiments. Large diagonal of corallites about 8 lines; diameter of the true calice 3 lines. Wenlock Edge, Aymestry, &c. Fig. 163, section, showing towards the centre the true calice with its walls. Fig. 164, older specimen.

Fig. 165.—*Alveolites Labechii.* Corallum massive, convex. Calices irregular, scarcely prominent, and having an inner process similar to that of *A. suborbicularis* of the Devonian rocks but much more indistinct. Wenlock, Benthall Edge.

Fig. 166.—Read *Monticulipora Fletcheri.* Corallum branching; calices of two kinds; some circular, others polygonal; these are smaller and placed between the former ones; almost without the tubercles which are generally present in this genus.

Fig. 167.—*Cœnites juniperinus.* Calices closely set, much elongated transversely, almost linear; upper margin concave, with a small median process; under edge has a small obtuse process on each side. Diameter of branches about 2 lines. Wenlock Edge.

Fig. 168.—*C. intertextus.* Resembles preceeding in its branching form, but its calices are not closely set, and are prominent, with a narrow subtriangular opening, presenting three small obtuse denticulations. Diameter of branches, 2 or 3 lines. Wenlock, Coalbrookdale, Lincoln Hill, Wenlock, &c. Llandovery to Wenlock.

Fig. 169.—*Cyathophyllum flexuosum.* Corallum branching; buds originate in the calyce. Diameter of large corallites, about 1¼ or 2 lines.

Fig. 170.—*C. truncatum.* Corallum forming a tall turbinate mass, formed by successive calycinal gemmation. Corallites narrow at their base, generally free above. Central fossula large and rather deep; outer part of calice flat; septa 50 to 60, closely set towards the circumference, only the largest reach the centre. Tabulæ small. Height of corallites 1 to 1½ inches, diameter somewhat less. Wenlock Edge, Much Wenlock, Benthall Edge, &c.

PLATE VIII.

Fig. 171.—*C. angustum.* Corallum simple, tall; septa very thin, about ½ a line apart, and united by dissepiments, so that when the epitheca has decayed the surface appears covered with regular, square cells. Tabulæ small and somewhat irregular, occupying only ¼ or ⅓ of the corallum, the rest consisting of oblique vesicular cells. Height about 4 inches, diameter about 1½ inch. Llandovery.

Fig. 172.—*C. articulatum.* Corallum composite; corallites tall, sub-cylindrical, with a thin epitheca calice circular, shallow; septa about 60; gemmation often intra-calicular; tabulæ small, irregular; septa well developed. Wenlock. Caradoc to Wenlock.

Fig. 173.—*Omphyma Murchisoni.* Corallum slightly bent near the base, and having a few root-like projections high up. Central part smooth. Septal fossulæ distinct. Septa about 60, intermingled with vescicles. Height about 2 inches. Differs from *O. subturbinatum* in the existence of the apparent vescicles, and in the fewer septa. Wenlock.

Fig. 174.—*Cystiphyllum cylindricum.*—Corallum tall, turbinate when young, afterwards cylindrical; epitheca strong, often having radiciform tubercles. Calice circular, rather shallow, covered with large irregular vescicles, with some appearance of septal striæ. Height about 2 inches. Benthall Edge. Llandovery to Wenlock.

Fig. 175.—*Cystiphyllum Siluriense.* Corallum turbinate, short, broad; epitheca thick, with some radiciform prolongations. Calice rather deep, very broad, septal striæ obscure; height about 1½ to 2 inches; diameter of calice somewhat more. Wenlock.

Fig. 176-7.—*Favosites alveolaris* (*F. aspera* M. Edwards.) Corallum massive; surface almost flat; calice unequal; tabulæ having 6 large, well marked, sub-marginal fossulæ; diagonal of large calices more than one line. Mocktree, Aymestry, Easthope. Caradoc to Ludlow.

Fig. 178-9.—*Ptychophyllum patellatum.* Corallum simple, pedicellated, short, mushroom-like; central fossula deep, surrounded by an elevation; septa nearly 100, thick exteriorly, slender towards the centre, where the larger ones twist and form a small columella; height about 1½ inches, diameter about 3 inches.

Fig. 180.—*Favosites Gothlandica.* Corallum massive, convex; calices somewhat unequal; septa 10 or 12; mural pores surrounded by a small rim, and forming on each wall two longitudinal series, which alternate; breadth of calices somewhat more than 1 line. Wenlock. Caradoc to Ludlow.

Fig. 181-4.—*Stenopora* (*Favosites*) *fibrosa.* Corallum massive, very convex; corallites radiating from the base of the corallum to its surface; tabulæ very closely set; mural pores large, closely set, alternating with the tabulæ; diameter of calices about $\frac{1}{10}$ of a line. Distinguished from *F. alveolaris* and *F. aspera* by the angular position of the pores and the regular size of the calices. Caradoc to Ludlow.

Fig. 185.—*Favosites multipora.* Corallum hemispherical; calices of equal size, regularly arranged, forming elongated hexagons; each side of walls with generally 3 series of pores closely set and arranged somewhat irregularly. Large diagonal of calices ½ line. Llandovery to Wenlock.

Fig. 186.—*F. cristata.* Corallum branched ; branches cylindrical ; calices somewhat unequal, often almost circular ; diameter of large ones about ½ a line. Wenlock, Ludlow, &c. Llandovery to Ludlow.

Fig. 187.—*Halysites catenularius.* Corallum very tall, composed of a nnmber of elliptic, tabular corallites, laterally united in lines so as to form large irregular reticulations. Size of calices varying from ½ a line to 1½ line in different specimens ; septa 12, reaching to nearly the centre of the calice ; tabulæ well developed, close, and horizontal. Wenlock and Benthall Edge. Llandeilo to Wenlock.

Fig. 188.—*Heliolites interstinctus.* Corallum massive, calices closely set and equal in size in the same specimen, their edge circular, slightly prominent ; a slight indication of columella; septa 12, alternately unequal ; diameter of calices about ⅔rds. of a line, of the polygonal divisions of cœnenchyma about ½ line. Lincoln Hill, Benthall Edge. Caradoc to Ludlow.

Figs. 189-90.—*H. tubulatus.* Corallum massive, irregularly convex ; calices circular, somewhat unequal ; septa generally 12, thick exteriorly ; diameter of calices about ½ a line ; walls distinct ; tabulæ closely set, concave in the middle. Benthall Edge, &c. Caradoc to Wenlock.

Fig. 191.—*H. discoideus.* From Murchison's Siluria ; undescribed.

Fig. 192.—*H.* (*Plasmopora* M. Edwards) *petalliformis.* Corallum massive hemispherical, free ; calices circular, nearly equal, not closely set. Space between the corallites divided into polygonal spaces by costæ, which do not always correspond with the septa. Septa 12, very slender, extending nearly to the centre. Diameter of calices about 1 line. Walls slender, not apparently perforated ; tabulæ large. Dudley. Caradoc to Wenlock.

PLATE IX.

Fig. 193.—*Labechia conferta.* Corallum massive, sometimes encrusting. The tabulæ are complete, but the septa rudimentary, which structure is characteristic of the *Favositidæ.* Walls not perforated. Wenlock, Benthall Edge, &c. Llandovery to Wenlock.

Fig. 194.—*Omphyma turbinatum.* Corallum simple. Edge slightly lamellated ; calyx large and deep, the middle of it is occupied by the uppermost tabula, presenting an extensive smooth surface. Septa 100 to 120, thin, somewhat unequal alternately. There are four well marked fossulæ, (not seen in the figure). Height of corallum 1½ to 2 inches ; diameter 3 inches or more. Distinguished from O. Murchisoni by its short form. Figure drawn from Mr. Maw's specimen. Wenlock Edge, Benthall Edge, &c. Caradoc to Wenlock.

Fig. 195.—*O. subturbinatum.* Corallum tall, with peduncle. Septa 80. Edge not lamellated. Smooth area in middle of calyx, much smaller in proportion than the last Some specimens attain a height of 7 or 8 inches. This species has often been confounded with the last, but differs from it in many particulars.

Figs. 196-7.—*Thecia Swindernana.* Corallum massive, not very thick ; calices vary in size and form ; Septa varying from 12 to 18, rather thick, not extending to the centre of the calyx. Tabulæ horizontal, strong. Breadth of calices about ½ a line. Lincoln Hill, Benthall Edge, &c. Fig. 197, section shewing the character of the tabulæ. Wenlock to Ludlow.

Figs. 198-9—*Palæocyclus porpita.*—Corallum discoidal, either free or having a conical, curved peduncle. Large septa 28 or 30, alternating with smaller ones. This species differs from *P. præacutum* in its alternately large and small septa. Diameter 5 or 6 lines. Height about 1 line. Fig. 199, under side showing the peduncle.

Fig 200.—*Petraia* (*Turbinolopsis*) *bina*, belongs, according to M. Edwards, to the genus *Cyathophyllum.* It is only known by casts, which are scarcely determinable. These show generally 72 septa of unequal size. Llandovery to Wenlock.

Fig. 201.—*Strephodes vermiculoides.* Synonymous with *Cyathophyllum truncatum.* Milne Edwards.

Fig. 202.—*Syringopora bifurcata.* Connecting tubes large, placed at about two lines apart. Diameter of corallites ½ to 1 line.

Fig. 203-4 Showing the character of the connecting tubes, characteristic of this genus. Llandovery to Ludlow.

Fig. 205.—*Palæocyclus præacutus.* Resembling *S. porpita* generally in form, but thinner. No peduncle Septa 48, of equal length. Diameter about 8, height 1 line. Fig. 206, under side of same. Llandovery to Wenlock.

Fig. 207.—*Sarcinula (Syringophyllum) organum.* Corallum massive; gemmation lateral; calices circular, unequal, prominent; costæ thin, extending throughout the inter-calicular space. Fossula rather shallow; septa 24 to 26, thick, unequal alternately; diameter of the calice about 1 line. Caradoc and Wenlock.

Fig. 209.—Read *Pseudocrinites magnificus.* Body orbicular; plates arranged in four series. The present species is separated from *P. bifasciatus* by the large number of fingers, no fewer than 34, which fringe the arms on each side. Length 1½ inch.

Fig. 210.—*P. quadrifasciatus.* Arms 4. In three of the four sides which compose the body, pectinated rhombs are present, one on each; on the fourth is an ovarian orifice. Fingers about 28 in each arm. Length $\frac{7}{10}$ inch.

Fig. 211.—*Prunocystites Fletcheri.* The two jointed arms seen rising from the upper part of the specimen are a characteristic mark of this genus. Body shaped like the fruit of the dog rose. Length 1 inch.

Fig. 212.—*Apiocystites pentremitoides* Body oblong, tetragonal; angles planed off and grooved to receive the four arms which spring from the apex; ovarian space six valved, pectinated rhombs 3. Closely allied to the preceding. Dudley.

Fig. 213.—*Echino-encrinites baccatus.* Length ½, breadth ⅔ inch. Body oval, formed of four series of rugose plates. Closely allied to the preceding, but without arms.

Fig. 214.—*E. armatus.* Body quadrate, broad; plates granulated radiately; basal plates forming an expanded cup. Length ⅜ inch.

Figs. 215-6.—*Marsupiocrinites cœlatus* Width of cups 1⅓ inch; length of fingers 3 inches; column round, cup formed of pelvis, 1 primary 1 secondary, 2 or 3 tertiary radials, and 5 primary interradials; pelvis pentagonal. Dudley.

Figs. 217-8.—*Crotalocrinus rugosus.* Pelvis pentagonal, supporting one heptagonal and 4 large hexagonal primary radials. The genus differs from *Cyathocrinus* in the vast number of its rays. Length of body, 11 lines; greatest width 1⅙ inches, length of fingers 3½ inches. Dudley.

Fig. 221.—*Periechocrinus moniliformis.* A complex crinoid, distinguished from *Actinocrinus* by having the secondary and tertiary radials flattened so as to form part of the walls of the cup, leaving only the fingers free. Length of cup 1⅚ inches; fingers nearly 4 times the length of the cup. Dudley. Llandovery to Wenlock.

Fig. 222.—*Eucalyptocrinus decorus.* Column round; body very large, oval; rays very short; pelvis small. Length from pelvis to base of mouth 2⅓ inches. Dudley.

Fig. 223.—*Ichthyocrinus pyriformis.* Column round. Length of pelvis to end of rays one inch. Kendal, Westmoreland.

Fig. 224.—*Cyathocrinus capillaris.* Section of stem pentagonal with a very small central canal, W. of Stiper Stones.

Fig. 225.—*C. goniodactylus.* Pelvic plates tuberculated; arms and fingers dichotomous.

Fig. 226 —*Taxocrinus tuberculatus.* Cup formed of pelvis, 1st and 2nd primary radials, and 5 primary interradials; plates tuberculated. Dudley.

Fig. 228.—*Platycrinus (Actinocrinites) retiarius.* Distinguished from *A. icosidactylus* by its 20 plumose fingers, without longitudinal sutures.

PLATE X.

Fig. 229.—*Glyptocrinus expansus.* Cup pyriform; pelvis of 5 plates. The chief distinctions between this genus and that of *Periechocrinus* are its distinctly quinque-partite pelvis and strongly radiated plates.[*]

Fig. 230.—*Tentaculites ornatus.* Average length 7 lines. Distinguished from *T. annulatus* by the thinner, more distant, and irregularly placed rings, and by smaller ones intervening in the flat interspaces. Caradoc to Wenlock.

Fig. 231.—*Spirorbis Lewisii* (*tenuis* Mc Coy). Discoid, of 1½ or nearly 2 whorls; diameter less than 1 line; surface marked with strong transverse and obscure spiral lines. Specimens often appear sinistral from the fact that the annelide (?) adhered to the inside chamber of the cephalopod on which it lived as a parasite. Wenlock to Ludlow.

[*] NOTE.—For full information on the structure, &c., of the Cystoidea, see E. Forbes's excellent article on "British Fossil Cystideæ," Mem. Geol. Survey, vol. ii, part 2, 1848.

Figs 232-3.—*Cornulites serpularius.* See Fig. 108.

Figs. 234-6 —*Serpulites longissimus.* Tube smooth, slightly calcareous, glossy, having two smaller tubes, stronger than the restof the shell, running along the convex and concave faces of its curve, and prolonged to the end. Upwards of a foot long. Surface with transverse undulations ; shell thin, glossy, opaline. Common in Up. Ludlow rock. Wenlock to Ludlow. Fig. 235, extremity of the same, figured from Mr Cocking's specimen. Fig. 236, reticulated scale-like markings on surface of same; possibly due to a Polyzoon.

Fig. 237.—*Acidaspis Barrandii* (*bispinosus*). Differs from *A. Brightii* by the posterior elongation of the glabella which terminates in two long slender spines, and by the anterior margin not being plicated but entire, and set with small conical spines. Body of 8 segments. Pygidium small.

Fig. 238.—*Beyrichia Klœdeni.* Surface of valve convex, 3 lobed; front lobes large, pyriform ; ventral extremity of anterior lobe extending below that of posterior ; middle lobe small, oval ; marginal rim distinct. Llandovery to Passage-beds.

Figs. 239-41.—*Acidaspis Brightii.* Glabella convex, narrow in front, widening towards the base, with a pair of large globular tubercles on each side, the posterior ones largest ; eyes situated near the base of the glabella, with a ridge extending from each to the antennary punctures (which are large) at the front of the glabella (fig. 241); neck segment prolonged backwards into a tapering, rounded spine. Length of head 2½ lines. Caradoc to Wenlock.

Fig. 242. —*Calymene Blumenbachii.* This genus, in common with *Homalonotus*, has 13 body rings. The greatly extended glabella is the chief characteristic of the species ; it occupies fully a third of the width of the head, and reaches to the margin, which is neither produced nor much reflexed. Caradoc to Ludlow.

Fig. 243.—*C. tuberculosa.* Resembles the preceding, in many points, but is a more depressed form, having a projecting recurved snout, and the glabella is not more prominent than the cheeks. Wenlock to Ludlow.

Figs. 244-7.—*Phacops Downingiœ.* Length 1½ inch. Broad in front; axis tapering regularly towards the tail. Head twice as long as broad. Eyes moderately large. Greatly resembles *P. apiculatus* of the lower Silurian, but the upper lobes of the glabella are more distinct, and the latter has a distinct apiculate or mucronate tail. Llandovery to Ludlow.

Fig. 248.—*Labrum of P. caudatus,* From a specimen in Mr. Cocking's collection.

Fig. 249.—*P. caudatus.* Four to five inches long. Thorax longer than either head or tail. Pleuræ once and a half as wide as the axis. Several varieties are enumerated, of which one, *P. nexilis*, is found in a Lower Ludlow quarry, near Newton, and at the High Vinnals, near Ludlow ; this form is remarkable for the narrow axis or glabella to the head. Llandovery to Ludlow.

Figs 250-2.—*P. longicaudatus.*—Distinguished from the last by the great length of its tail, narrower axis, and mucro in front of the head ; the axis is also less prolonged, and the furrows on each side more arched. N.B.—In fig. 252 read *P. longicaudatus.* Wenlock to Ludlow.

Fig. 253.—*Encrinurus variolaris.* Similar to *E. punctatus* in the head and thorax, but the glabella is much more inflated, the angles of the head are obtuse, not spinose, and the surface of the glabella is clothed equally with large tubercles.

Figs. 254-5.—*Sphærexocus mirus*—Specimens frequently found rolled up into a complete ball, of which the large head forms a very conspicuous part. General form oblong. Length about an inch and a half. Head more than a third of the whole length, and remarkable for its spherical glabella. Caradoc, Llandovery ? Wenlock.

Fig. 257.—*Proetus Stokesii.* Ovate ; angles of head reaching to pygidium ; thorax as long as head; pygidium semi-elliptical, with a broad tumid margin, and 6 wide flattened ribs on the side. Length 5½ lines. Llandovery to Wenlock.

Fig. 258. *P. latifrons.* Ovate ; head and thorax of equal length ; pygidium as long as 6 segments of the thorax ; spinose angles reaching to the 6th segment ; glabella wider at base than in front, not reaching to the anterior margin ; axis of body as wide as pleuræ; pygidium semi-circular. Length 10 lines. Llandovery to Ludlow.

Fig 259.—*Lichas anglicus.* Cephalic shield about 4 inches long, produced into small spines ; granulation scattered ; body ovate, very flat ; thorax of 10 segments ; pleuræ flat, falcate ; pygidium semi-oval, apex terminating in two long spines ; axis of one joint, running out at the margin into long spines. Wenlock to Ludlow.

Fig. 260.—*Homalonotus delphinocephalus.* Head forms nearly a right angled triangle, described by Salter as having the shape of a "pointed gothic arch"; eyes very convex, and finely reticulate, with minute lenses, so closely connected with the free check that they were easily separated, and are therefore seldom found. Largest specimen 6 by 3 inches.

Fig. 261.—*Illænus nexilis.* Intermediate in character between *Il. Thomsoni* and *Il. Bowmanni,* not having the abruptly reflexed pleuræ or the long truncate angles to the tail of the former, nor the narrow neck-furrow of the latter. Llandovery.

Fig. 262.—*Il. insignis.* Often confounded with the much more common *Il. Barriensis,* from which it differs in its greater convexity, its obliquely placed eyes without a fold beneath them, the close lineation of the surface, and, above all, its highly convex tail-piece. Length 3-4 inches.

Fig. 263.—*Il. Barriensis.*—More depressed than the preceding; margin obtuse, that of *Il. insignis* being recurved; surface coarsely striated, squamose on the head in old specimens; the very convex eye-lobe *(palpebra),* is supported by a long cushion, subtended by a deep furrow which encircles it, and which ends in front in a deep depression. Length often 6 inches. Llandovery to Wenlock.

Fig. 264.—Drawn from a fine specimen in Mr. Cocking's possession, which shows the lenses and the cups *(retinæ)* in which they rested.

PLATE XI.

For title of Plate read POLYZOA or BRYOZOA.

Fig. 265.—*Discopora antiqua.* Under surface smooth or marked with concentric lines; upper margin of cells arched, slightly projecting; cell openings irregular.

Fig. 266.—*Ceriopora (Stenopora) granulosa.* Corallum of irregularly swollen, cylindrical, dichotomous branches, about 2 lines in diameter.

Fig 267.—*Diastopora (Berenicea) irregularis.* Cell openings round, remote on the flat surface of the Polypidom, more crowded where the surface is uneven, more or less disposed from a centre or radiately concentric.

Fig. 268.—*Discopora (Monticulipora) squammata.* Variable in form; calices about $\frac{1}{5}$—$\frac{2}{5}$ths of a line in diameter, resembling those of *Alveolites,* but without septal processes. Wenlock, Benthall Edge.

Fig. 269.—*Escharina angularis.* In this genus, (allied to *Ptilodictya*), the corallum is free or encrusting, never rooted; cells shallow, oblong, furnished with an operculum.

Fig. 270.—*Fenestella assimilis.* A fan-shaped calcareous expansion, of which the rays are connected by transverse dissepiments, which are usually without cells; exterior of branches rounded, covered with a porous layer; interior with a keel which separates two rows of tubular cells. Caradoc and Wenlock.

Figs. 271-3.—*Fenestella Lonsdalii.* Branches slender, close or near each other and bifurcating; foramina numerous and close; in the internal net-work the intervals are oval, variable in size, and with rounded angles.

Fig. 274.—*F. reticulata.* Branches irregularly anastomosed; foramina large, rather distinct.

Fig. 275.—*F. Milleri.* Corallum forming undulating, fan-like expansions, 2-3 inches long; dissepiments thin, about 2 lines apart. Caradoc and Wenlock.

Fig. 276.—*F. subantiqua.* Corallum of very slender, straight interstices, branching seldom; fenestrules rectangular, oblong. Caradoc and Wenlock.

Fig. 277.—*Polypora crassa.* Corallum forming a delicate, reticulated, calcareous expansion, usually fan-shaped. Distinguished from *Fenestella* by the pores on the uncarinated interstices, and from *Retepora* by its non-poriferous dissepiments.

Fig. 278.—*Glauconome disticha.* Branches tripinnate, marked with longitudinal granulose striæ on one face, and keeled on the other, with a row of large oblong pores on each side, and a row of small ones on the medial keel. Caradoc and Wenlock.

Fig. 279.—*Fenestella antiqua.* Branches bifurcated; transverse processes very apparent; pores not numerous nor close. Caradoc and Wenlock.

Fig 280.—*Heteropora (Polypora) crassa.* Branches thick; tubes small, radiating. Nicholson observes that true *Heteropora* did not appear before the Jurassic epoch.

Fig 281.—Read *Retepora infundibulum.* Corallum of a fan or cup-shaped net-work, frequently anastomosing. The absence of non-poriferous dissepiments separates the genus from *Polypora,* and its numerous rows of cells and the absence of a layer of vertical tubuli on the non-poriferous face from *Fenestella.*

Figs. 282-5—*Ptilodictya lanceolata.* Axis thin, laminar, set with short, ovate, or sub-tubular cells on both sides. Most specimens splitting in a plane parallel to the central axis present a flat surface and display rhomboidal spaces, long in the centre and more diagonal towards the outside, each containing an ovate cell. Wenlock Edge. Llandeilo to Wenlock.

Fig. 286.—*P. scapellum.* Referred by Mr. Etheridge to *Fenestella.* Llandovery to Wenlock.

Fig. 287.—Read *Monograptus priodon* (*Ludensis* Sil Syst). Incorrectly inserted here among the Polyzoa, being a Hydrozoon. (See p. 31). Polypary several inches long, gradually increasing in width to about $\frac{1}{10}$ inch ; hydrothecæ 20-25 to the inch, forming an angle of about 40 degs with the axis, cylindrical, tapering gradually to near their distal end, when they bend slightly outwards, and then downwards (forming a double curve), while they maintain the same diameter, and terminating in a rounded aperture. Caradoc to Ludlow.

Mr. Hopkinson has furnished the following list of graptolites from the Wenlock formation.

RHABDOPHORA. *Monograptus colonus* ; see fig. 577. Burrington, Onny. *M.* (? *Halli*). Onny. *M. vomerinus.* Onny. *Cyrtograptus Ludensis.* Teme side. *C. Linnarsoni.* Onny. *C. Murchisoni.* Onny near Plowden.

CLADOPHORA. *Callograptus Ludensis* Burrington ; see fig. 582.

Figs. 288-93.—*Pentamerus Knightii.* Named after Mr. Knight, of Downton Castle. The shell easily separates along the septum which divides each of the valves into two chambers, and frequently the V-shaped space or fifth central chamber is thus exposed. This was probably occupied by the digestive organs, the lateral spaces containing the arms and ovaries. Fig. 291, diagram of the above arrangement (after Davidson). S. septum of ventral valve. V. dental plates, which form between them the V-shaped chamber ; m and n, septa in dorsal valve ; o, hinge plates. Fig 290, transverse section. The parts are designated by the same letters. Fig. 292, named by Sowerby *Aylesfordii*, is a flatter variety of *P. Knightii.* Fig. 293 ; a young shell from Benthall Edge. Wenlock to Ludlow.

Figs. 294-302.—*P. galeatus.* Much more variable in shape than *P. Knightii* ; chiefly distinguished from that species by the median septum which in *P. Knightii* extends along ⅔rds of the length of the V-shaped central chamber, but in this only extends ⅓rd; see fig. 302. Length 19-14, width 18-12 lines. Wenlock to Ludlow.

Figs 303-6.—*P. rotundus.* Orbicular or a little wider than long ; it varies in the presence of ribs on the sides of the valves. Length 7-10, width 7½.

Figs. 307-10.—*P. linguifer.* Distinguished from *P. galeatus* by having the mesial fold on the dorsal, and the sinus on the ventral valve, the contrary being the case with the latter. The V-shaped chamber is small, as is also the septum which supports it. From 9 to 10 lines wide and long. Benthall Edge. U. Llandovery (?) to Wenlock.

Figs. 311-4.—*Retzia Salteri.* Wider than long ; ribs strong and angular ; slight mesial fold on the dorsal valve with four smaller ribs, of which the central are narrowest. In the corresponding sinus of the ventral valve there is a narrow central rib with a larger one on each side ; beak truncated with small circular foramen. Length 6, width 7 lines. Wenlock Edge, Benthall Edge.

Figs. 315-6.—*R. Baylei.* Only one small central rib on dorsal valve with two corresponding on the ventral. Beak entire, with circular foramen and deltidium. Same localities. Length 4, width 4-5 lines.

Figs. 317-8.—*R. Bouchardii.* Larger than either of the preceding ; more ribs on the lateral parts of valves Four very narrow central ribs on the dorsal, and three in the sinus of the ventral valves, of which the centre one is much the narrowest. Extremity of beak truncated by a small circular foramen. Length 8-6, width 7 lines.

Figs. 319-21.— Read *Atrypa Barrandii.* Shell from 3 to 4 lines wide and long ; beak truncated with small foramen. Length 4-3½, width 4-3 lines. Buildwas.

PLATE XII.

Figs. 322-3.—*Rhynchonella Stricklandii* Surface of valves covered with from 28-34 simple, angular ribs, of which 6-8 occupy the fold or sinus. Length 12-15, breadth 13-16 lines. Not a common shell.

Figs. 324-1.—*R. cuneata.* Ribs 10-14, of which 4-5 compose the fold, and 3-4 the sinus. Length 10, width 9 lines. Benthall Edge, Lincoln's Hill.

Figs. 326-33.—*R. borealis.* Very variable in shape and in the number of ribs on the fold and sinus; these consist of from 10 to 20, of which 2-6 compose the fold, and 1-5 the sinus. On either side of the beak a smooth area occurs. Length 14-10, width 17-11 lines. Wenlock Limestone. Llandovery and Ludlow.

Figs. 334-41.—*R. Wilsoni.* Depth of shell often twice as great as its length or width: but such specimens chiefly occur in the Aymestry Limestone. The ribs, of which there are 30-40, are sometimes marked by an indented line near the margin. *R. crebricostata*, from the Llandovery (fig. 337), *R. sphæroidalis* (figs. 338-340), from Botville, as well as *R. pentagona* (fig. 341), are all varieties or specimens of young individuals of this species. Wenlock to Ludlow.

Figs. 342-5.—*R. diodonta*, a variety of *R. borealis*.

Figs. 346-8.—*R. Davidsoni.* A variety of R. Wilsoni, from which it differs in having fewer and stronger ribs. Brocton, Burton. Wenlock to Ludlow.

Figs. 349-51.—Read *Dayia navicula.* Removed by Dr. Davidson from the genus *Rhynchonella* to that of *Dayia.* For description of the interior of this interesting shell see Pl. xxi. figs. 749-51.

Figs. 352-5.—*R. deflexa.* Dorsal valve ventricose, its umbone is much incurved, higher, and projecting beyond the small, closely incurved beak of the ventral valve. The ribs vary in number and strength, and are crossed by fine, concentric, projecting lines. Length 9-6, width 8-6 lines. Benthall Edge, Wenlock Edge, Lincoln's Hill, &c.

Figs. 356-8.—*Orthis Lewisii.* Hinge line straight; dorsal valve semi-circular with a median depression or sinus; area large, triangular, with an open fissure; ventral valve somewhat keeled. Length and width 3½ lines.

Figs. 359-60.—*O. Bouchardii.* Marked by the imbrications on the surface of the ribs, which are very symmetrical: in young specimens their number is 6-8, but they increase rapidly with age. Length 6½, width 7 lines. Benthall Edge.

Figs. 361-3.—*Rhynchonella Lewisii.* Surface ornamented with many projecting, scale-like, concentric ridges, which are more numerous near the margin; ribs variable. The mesial fold, as seen in fig. 362, is remarkable in its form, though in young specimens the fold and sinus are scarcely developed. Length 8, width 10 lines. Benthall Edge. U. Llandovery (?) to Wenlock.

Figs. 364-5.—*Orthis crassa.* Shell almost circular, in which respect, as in its being sometimes almost globular, it differs from *O. elegantula*, which it otherwise closely resembles. Length 6-7 width 6-8 lines. Wenlock to Ludlow.

Figs. 366-7.—*O. hybrida.* Valves nearly equally convex; hinge line very short; surface with fine thread-like striæ, increasing in number towards the margin. Length 5, width 5½ lines. Buildwas. Caradoc to Ludlow.

Figs. 368-70.—*Orthis rustica.* Dorsal valve deeper than ventral; ribs 50-120, rounded; of which two-fifths are inserted between the longer ones, a peculiarity very characteristic of this species, which is considered by Salter to be, as well as *O. rigida*, a variety of *O. calligramma.* Length of large specimens 16, width 9 lines. Benthall Edge, Lincoln's Hill, Buildwas, &c.

Figs. 372-3.—*O. æquivalvis.* Shell almost circular. Convexity of valves nearly equal, without fold or sinus. Surface marked with thread-like radiating striæ, crossed by concentric lines. Length 10, width 11 lines.

Figs. 374-7.—*Atrypa marginalis.* Dorsal valve convex and trilobed; ventral, almost flat, with rather deep sinus; ribs bifurcating, every 3 or 4 clustered together and separated by grooves. Length 8, width 9 lines. Caradoc to Wenlock.

Figs. 378-80.—*A. imbricata.* Differs from the preceding in its greatly incurved beak, and its more convex valves; the ribs also are more numerous, and not scale-like. Caradoc to Wenlock.

Figs, 381-3—*Nucleospira pisum.* Valves nearly equally convex; beaks very small, incurved; hinge line straight, short; dorsal valve with a faint line along its centre, which becomes a depression or salcus; surface covered, when perfect, with hair-like spines. Length of large specimens 5½, width 6 lines. Recent investigations by Dr. Davidson and Mr. Glass have shown that this minute shell possessed a pair of internal spires, each consisting of about 6-7 convolutions. Abundant in Wenlock Limestone and Shale.

Figs. 384-5.—Read *Streptorhynchus nasuta*. Both valves convex ; the beak of ventral truncated by a circular foramen ; sinus deep ; fold of dorsal crossed by numerous scabrous ridges of growth. Length 3, width 3½ lines. Doubtfully assigned previously to the genus *Cyrtia*. Benthall Edge.

Fig. 386.—*Eichwaldia Capewelii* Dorsal valve with mesial fold; ventral, with broad shallow sinus. Surface covered with a net-work of six-sided cells, of which Dr. Davidson has counted nearly 3000 on one valve. Length 8, width 9 lines. Walsall, Dudley.

Fig. 387.—*Chonetes minima*. Ventral valve convex ; dorsal, concave. Surface with 10-20 principal radii, and a shorter one between each pair; inner surface marked by numerous tubercles, Length of large specimens 2, width 2½ lines. Elton Lane, Burrington. Llandovery to Ludlow.

Fig. 388.—*Leptæna lævigata*. Surface smooth and shining, with a few radiating striæ and concentric lines. Hinge line prolonged into angular ears ; dorsal valve concave ; ventral, convex. Length 4, width 7 lines. Burrington, Clungunford, Stoke Wood. Wenlock to Ludlow.

Fig 389.—*Chonetes striatella* (*lata*). Externally like *Leptæna*, but its internal structure shows that it belongs to the family *Productidæ*. Distinguished by 4 slanting, tubular spines on each side of the hinge line. Abundant in Up. Ludlow Rock. U. Llandovery (?) to Ludlow.

PLATE XIII.

Figs. 390-3.—*Strophomena rhomboidalis* (*S. depressa* and *tenuistriata* Sil. Syst). Surface marked by striæ and undulating concentric wrinkles ; valves flat near hinge, but afterwards bending nearly at right angles (*geniculate*). Dorsal valve concave ; ventral, convex ; foramen found in young specimens but disappears with age. Fig. 391, muscular impressions of ventral valve, which has two diverging teeth which fit into sockets in the dorsal valve. Fig. 392, muscular impressions of dorsal valve. Fig. 393, section through both valves. Length 14-15, width 20-42 lines. Caradoc to Carboniferous.

Figs. 394-7.—*S. euglypha*. Dorsal valve convex, ventral concave ; the reverse being the case in the preceding species, a fact first noticed by Davidson. Surface ornamented with ribs between which 3 or 4 much finer ones occur, length and breadth 22 lines. Fig. 396, muscular impressions of the ventral ; fig. 397, of the dorsal valve. Fig. 395, section through both valves. U. Llandovery to Ludlow.

Figs. 398-400.—*S. funiculata*. Resembles the preceding, but is much smaller and wider in proportion to its length, the striation also is more uniform, and the muscular impressions longer and narrower. Length 8-6, width 13-15 lines. Benthall Edge, Lincoln's Hill, Leintwardine. Fig. 399, muscular impressions of ventral valve. Llandovery (?) to Wenlock.

Figs. 401-2.—*S. Dayi*. Dorsal valve slightly concave, and ventral convex ; surface ornamented with about 13 principal radii with wide interspaces, in the middle of which a rather stronger rib occurs. Length 5, width 6 lines. Buildwas.

Figs. 403-4.—*S. Orbignyi*. Resembles *S. pecten* but differs chiefly in the shape of its muscular impressions, (fig. 404). Length 13, width 20 lines.

Fig. 405.—*S. imbrex*. Ventral valve very convex, sometimes geniculated like the dorsal valve of *S. euglypha*. The interspaces between the numerous thread-like radii which ornament the surface filled with much finer ones. Length 25, width 29 lines. Caradoc (?) to Wenlock.

Figs. 406-7.—*S. filosa*. The space between the valves is so small that but little room seems to have been left for the animal to occupy. Ribs fine and numerous, muscular impressions on the ventral valve (fig. 407), broad and fan-like, and characteristic. Length 16, width 22 lines. Burrington, Benthall Edge, Ludlow, Stokesay, &c. Wenlock to Ludlow.

Figs. 408-13.—Read *Whitfieldia tumida*. This shell was named *Meristella* until its internal structure (Pl. xxi fig. 752), was ascertained. Variable in form. The fold and sinus which in young specimens is very faint, in old ones becomes a deep curve, (fig. 410). Surface smooth. Length 23-16, width 23-20 lines. Benthall Edge, &c. Wenlock to Ludlow.

Figs. 414-5. *L. Fletcheri*. Distinguished from *Leptæna transversalis*, with which it has been confounded, by its small and scarcely projecting beak, its less concave and convex valves, and its striation. Length 7, width 12 lines. Fig. 414, ventral ; fig. 415, dorsal valve. Benthall Edge.

Figs. 416-8.—*Meristella ? Circe.*—Rhomboidal; sinus in ventral valve; no real fold. Possibly belonging to the genus *Merista*, which is characterised by the shoe-lifter process, (Pl. xxi, fig. 755). Length 8-7, width 5-5½ lines.

Figs. 419-22.—Read *M.* (?) *nitida*. Shell ovate. Length 5-7, width 4-5 lines. Traces of internal spiral coils are sometimes found (fig. 422). This shell probably belongs to the genus *Athyris*. Dav. Benthall Edge.

Figs 423-5.—Read *Spirifera* (*Cyrtia*) *exporrecta*. Observe its deltidium (fig. 423), traversed by a depression, sometimes ending in a small oval aperture, through which probably a pedicle issued for its attachment to marine objects. Length 13-15, breadth 12-14 lines. Llandovery to Ludlow.

Figs. 426-7.—*Spirifera plicatella.* Rhomboidal, longer than broad; ventral valve most convex, with deep sinus; dorsal, with mesial fold; surface covered with numerous ribs, crossed by concentric lines. Length 14-13, breadth 15-16 lines. Wenlock to Ludlow.

Figs. 428-9.—*S interlineata.* Probably a variety of the preceding.

Fig. 430.—*S. sulcata.* Transversely rhomboidal. Ventral valve deepest; 2 or 3 ribs on each side of the sinus. Surface of both valves crossed by projecting laminæ. Length of large specimen 6, width 10 lines, generally much smaller. Benthall Edge, Wenlock Edge.

Figs. 431-3.—*S. elevata*, Variable in shape and size. Probably a variety of preceding; generally 4-6 ribs on each side of sinus. Length 9-7, width 12-9 lines. Llandovery to Ludlow.

Figs. 434-5.—*S. crispa.* Transversely oval; valves moderately convex. Closely resembles the preceding, especially in young specimens. Length 5, width 6-5 lines. Llandovery to Ludlow.

Figs. 436-7.—Read *Glassia depressa*. Transversely obovate; mesial fold very slightly raised; sinus shallow; beak small, pointed, incurved. Length 5, width 6½ lines. Formerly classed as an *Athyris.*

Figs. 438-40.—*G. compressa.* Orbicular; surface smooth, with slightly projecting, concentric lines: probably the same as *G. obovata* (fig. 589). Length 5½, width 6 lines.

Figs. 441-3.—*Lingula Lewisii.* Subquadrate, oblong; sides almost parallel; beaks obtusely angular; valves almost equally deep; surface nearly smooth. Distinguished from *L. granulata* and *L. tenuistriata* by its non-recticulated surface. Length of large specimen 14, width 10 lines. Wenlock to Ludlow.

Fig. 444.—*L. striata.* Squarish-ovate. The undulating concentric striæ which ornament the surface can hardly be seen without the aid of a lens. Length 9, width 6 lines. Whitcliffe, Ludlow. Wenlock to Ludlow.

Fig. 445.—*Discina rugata.* Nearly orbicular; lower valve with fissure extending from near the centre to the posterior margin. Length 9-7, width 9-6 lines. Burton, Brocton, Stokesay, &c. Llandovery to Ludlow.

Figs. 446-7.—Read *Meristina didyma.* The single loop, which has been recently found to unite the lamellæ of its spines, shows that this species belong to the genus *Meristina.* Pentagonal; beak small, incurved; both valves with mesial sulcus; surface smooth, with concentric lines. Length 10, width 10 lines. Lincoln's Hill. Llandovery to Ludlow.

Figs. 448-50.—*Lingula Symondsii.* Ovate; surface smooth. Length of large specimen 12, width 7 lines; often much smaller. Buildwas, Wenlock Edge, &c. Llandovery to Ludlow.

Figs. 451-3.—*Siphonotreta Anglica.* Beak terminated with small foramen; surface studded with slender tubular spines, arranged in quincunx form. A rare and curious species. Length 6, width 5 lines.

Figs. 454-5.—*Crania Siluriana.* Ventral valve adhering to some substance by its entire surface; dorsal valve slightly conical; surface rugose. Length 4, width 4 lines.

Fig. 456.—*C. Grayi* Surface ornamented with ribs and interpolated riblets, radiating from the apex. Length and breadth of large specimen 4 lines.

Figs. 457-8.—*C. implicata.* Very minute. Ventral valve ornamented with step-like bands of growth. Llandovery to Ludlow.

Fig. 459.—Read *Dinobolus Davidsoni.* Shell transversely oval. Valves nearly equally convex; ventral, with a short obtuse beak. Surface smooth, marked with concentic lines of growth, Length 14, width 16 lines.

Figs. 460-1.—*Discina Morrisii* Surface smooth. Fissure of the lower valve very broad. A somewhat doubtful species. Length 5-7, width 5-6 lines. Wenlock to Ludlow.

Fig. 462.—*Orbiculoidea Forbesii* Shell longitudinally oblong. Both valves convex. The small circular perforation through which the peduncle passed, is placed close to the margin of a deep furrow, which varies in length with age. Length 13-12, width 13-10 lines.

See Plate xxi for *Atrypa asperula*, figs. 753-4; *A. Mawii*, figs. 742-3; *Glassia obovata*, figs. 744-7; *G. elongata*, figs. 739-41; *Waldheimia Mawii*, figs. 735-8.

PLATE XIV.

Fig. 463.—*Pterinea asperula* (enlarged). Anterior wing rounded, less than half the length of the posterior. Surface covered with rough ridges separated by flat spaces, crossed by fine lines of growth. Length from the beak to posterior end 3¼ lines.

Fig. 464.—*P. tenuistriata*. Length slightly exceeding width. Anterior wing half the length of the posterior. Surface with irregular concentric lines of growth, crossed by very fine radiating striæ. Hinge line crenulated. Length 4½ lines. Caradoc to Ludlow.

Fig. 465.—*P. lineatula* (*lineata*). Aliform, tumid; beaks rather large, obtuse; posterior wing very large, acutely pointed; surface radiated with close, fine, unequal lines, crossed by occasional small concentric waves of growth. Length from beak to respiratory angle, 1 inch. Mc. Coy remarks that the figure given in Siluria, of which this is a copy, "seems altogether different by its greater obliquity and its stronger, fewer, and more distant ridges". Llandovery to Ludlow.

Fig. 466.—*P. retroflexa*. Surface marked with sharp striæ parallel with the margin; internally the marks of a strong, bilobed, anterior, adductor muscle just in front of the beak; two slender, posterior teeth about ⅔rds. the length of the hinge line; a few very small ones beneath the beak; Llandovery to Ludlow.

Fig. 467.—*Cardiola fibrosa*. Surface covered with fine sharp longitudinal striæ from the beak to the margin (not indicated in the figure which is drawn from Sowerby's), crossed by equal, fine, close, thread-like, rounded ridges. Length 10 lines. More oblique and more finely striated than *C. interrupta*. Wenlock to Ludlow.

Fig. 468.—*C. interrupta*. Ovato-trigonal, slightly oblique; beaks obtuse, prominent; surface regularly radiated with close obtuse ridges, interrupted by deep, irregular, concentric sulci. Length upwards of an inch. Abundant. Caradoc to Ludlow.

Fig, 469.—*Ambonychia ? striata*. Obliquely ovate, beaks very prominent, obtuse; surface covered with subequal narrow ridges separated by flat spaces. Length from beak to anal angle 1⅝ inches; impression of a thin lateral tooth beneath the hinge-line. Wenlock to Ludlow.

Figs. 470-1.—*Grammysia cingulata*. Oblong; valves slightly convex; beaks obtuse, close to the anterior end which is rounded; anterior lunette ovate, deep; posterior lunette as long as the hinge; in the right valve one deep sulcus extends from the beak to the margin, often with a second sulcus in front of it; left valve with three corresponding sulci. Surface with small unequal concentric wrinkles and lines. Length 1¼ inch. A variable species. Wenlock to Ludlow.

Figs. 472-3.—*Mytillus gradatus*. Transversely ovate, not lobed, with 3 or 4 strong furrows and a few intermediate striæ; beaks near the small, rounded anterior side; anterior muscular impression small, ovate, half way down; posterior, obscure; conspicuous from its marked periods of growth and its even, non-lobed character.

Fig. 474.—*M. mytilimeris*. Shell smooth, pointed, ovate, without the short, flat, posterior wing; beaks pointed, prominent. Young shell proportionally broader than the old one. Lamellæ faint. Caradoc (?) to Ludlow.

Fig. 475.—Read *Modiolopsis antiqua*. The byssiferous sinus and oblique depression from it, and the increasing width of the posterior end, separate the species of this genus from *Orthonota*. Glass House, E. of May Hill

Fig. 476.—*Pterinea* (?) *planulata*. Inequivalved; posterior side broadest and largest, divided by a constriction in the ventral edge; in the left valve a sinus in the lines of growth along the posterior slope; surface with scales of growth; beak overhanging the short anterior side; valves frequently striated.

Figs. 477-8.—*Pleurorhynchus æquicostatus*. Very obliquely dentoidal; The cordiform depression (fig. 488), bounded by a rounded ridge. Surface covered with ridges and furrows radiating from the beak, crossed by many fine equal striæ; (nat. size).

Fig. 479.—*Acroculia prototypa (Nerita spirata Phill)*. Subglobose, smooth; spire small. Height and diameter, 9 lines.

Fig. 480.—*A. (Nerita) haliotis.* Mouth very wide; outer lip irregularly undulated; spire of 2 lateral convex whorls, scarcely rising above the level of the body whorl; surface covered with flexuous striæ, all crossed by waving lines of growth. Width 1¼ inch. Llandovery to Wenlock.

Fig. 481.—*Murchisonia Lloydii.* Spire of about 4 whorls, with a square keel; between this and the suture are two thin, thread-like ridges on each whorl, and on the body whorl are 6 or 7 similar ones; Length 1½ inch. Wenlock to Ludlow.

Figs. 482-3.—*Euomphalus rugosus.* Body whorls bounded externally by a strong, obtuse, spiral keel, beneath which are two other less marked keels; surface covered with undulating laminæ of growth. Diameter nearly 2 inches.

Fig. 484.—*E. discors.* Spire depressed below the level of the last whorl. Upper fourth of the basal whorl bounded by an obtuse spiral ridge, from which the sides slope outwards to a similar ridge at the circumference, there being a less prominent one between them; umbilicus wide. Upper surface covered by imbricating laminæ, forming thick scales on the ridges; on the under surface the striation is finer. Diameter 2¼ inches.

Fig. 485.—*E. funatus.* Very obtusely conic. Spire of about 2 convex whorls; mouth nearly circular; umbilicus small; surface marked with about 20 round, cord-like ridges, crossed by fine, direct lines of growth. Diameter 1½ inches. Distinguished from *E. sculptus* by the wider spaces between the ridges, and the transverse, scaly lines of growth. Llandovery to Ludlow.

Fig. 486.—*E. sculptus.* Discoid, much depressed; about 3 whorls; mouth nearly circular; umbilicus wide; surface covered with numerous, close, cord-like ridges. Diameter 1¼ inches. Caradoc to Ludlow.

Fig. 487.—*E. alatus.*—Umbilicus large; whorls bearing 4 broad wings, at first free, then attached to the spire; radiately striated. A Swedish form described by Hisinger; Leth. Suec, p. 36. Wenlock to Ludlow.

Fig. 488—*E. centrifugus.* Discoid, of 3-4 gradually increasing volutions; whorls very convex; a thick, flattened, plate-like keel extends from the circumference on a level with the lower edge; upper surface has strong, spiral sulci; under surface and keel crossed by fine lines of growth. Diameter 2¼ inches. Wenlock to Ludlow.

Figs. 489-91.—*Bellerophon* dilatatus.* Shell very thin; whorls suddenly expanding into a nearly circular mouth; keel narrow, flattened, only slightly projecting; umbilicus wide; length at mouth 2¾, width 2½ inches. Caradoc to Wenlock.

Fig. 492.—*B. Wenlockensis.* Globose; umbilicus very small; mouth transversely lunate, having a deep, obtuse V-shaped sinus; surface with coarse, close ridges meeting at the prominent and well-defined keel. Width at mouth 2½ inches.

Figs. 493-4.—*Holopella gregaria.* Spire about 6 whorls which are obscurely angulated; surface with transverse lines of growth. Length 5 lines. Distinguished from *H. obsoleta* by its smaller size, more tapering form, and its subangulated whorls. Wenlock to Ludlow.

*NOTE.—*Bellerophon* belongs to the order *Heteropoda* or *Nucleobranchiata.*

PLATE XV.

Fig. 495.—*Nautilus Bohemicus* (*Lituites Biddulphii. Sil.*) Section subquadrate; siphuncle nearly central. The surface of this specimen is covered with the minute parasite *Spirorbis Lewisii* which attached itself to the inner surface of the shell when vacated by its original owner. Ludlow. Wenlock to Ludlow.

Figs. 496-7.—*Goniatites? nautilaceum.* About 24 ribs in half a whorl; diameter 2¼ inches. Charlton brook, south end of Longmynd.

Figs. 498-9.—*Phragmoceras ventricosum.* Much flattened; aperture in youth open, as the animal advanced in age this developed into a larger one, somewhat transverse, and a smaller, with a passage between them, which finally closed up: see fig. 499. Length 6¼, diameter 3½ inches. Mocktree, Aymestry. Llandovery to Ludlow.

Fig. 500.—*Cyrtoceras compressum.* Body-chamber as long as the basal diameter; siphuncle external; curved length 4½ inches. Leintwardine, Aston, Stoke Wood. Llandovery to Ludlow.

Fig. 501.—*Trochoceras* (*Lituites*) *giganteum.* Since its whorls do not lie exactly in the same plane, and are in contact (the reverse being the case in *Lituites*, which, otherwise, it closely resembles in the straightness of the last portion), this species has been removed by Blake

to the genus *Trochoceras*. Diameter 4½ inches. Leintwardine, Stoke Wood. Wenlock to Ludlow.

Fig. 502.—*Lituites ibex.* Resembling *Orthoceras ibex* except in the curvature ; fine riblets between the ribs are sometimes seen. Length sometimes 2¾ inches. Leintwardine, Stoke Wood etc.

Fig. 503.—*Orthoceras ibex.* Not curved. The undulating ribs separate this species from *O. tracheale*, and the transverse striation from *O. tenuiannulatum.* The septa lie in the hollows of the ribs. Long diameter 9½-4½ lines. Mocktree, Stoke-wood, etc. Wenlock to Ludlow.

Fig. 504.—*O. attenuatum.* A more than doubtful species. The figure (from Murchison's Siluria) is said to have been drawn from a specimen in the Ludlow museum which is not forthcoming.

Fig. 505.—*O. fimbriatum.*—Ornaments longitudinal ribs, crossed by undulating, festoon-like lamellæ ; siphuncle central. Allied to, and often not easily distinguished from, the next species. Wenlock to U. Ludlow.

Fig. 506.—*O. annulatum.* Very variable. Ribs, which are always present, vary much in size and character, crossed by transverse, festooned, lamellar riblets. Greatest length 13, diameter, 2½ inches. Caradoc to U. Ludlow.

Fig. 507—*O. angulatum.* Body-chamber slightly longer than the diameter at its base. Ribs acute, longitudinal, 32-42. Fine transverse riblets mark the intervening spaces. Septa slightly oblique ; siphuncle nearly central. Length probably 15 inches. Caradoc (?) to U. Ludlow.

Fig. 508.—*O. Bacchus.* Ornaments are ribs of three sizes, which as they approach the body chamber become uniform. Differs from *O. angulatum* in having intermediate riblets, and from *O. filosum* in the greater size of the primary. Length of largest specimen 13, diameter 4 inches. Figured from a fragment in the Ludlow Museum. Llandovery to U. Ludlow.

Fig. 509.—*O primævum.* Surface with transverse striæ, rarely preserved. Body chamber very long ; aperture prolonged into two tongues, of which one is longer than the other ; siphuncle central. Longest specimen 9 inches. Common. Wenlock to U. Ludlow.

PLATE XVI.

Fig. 510.—*O. Duponti.* Length of body-chamber 4 times its basal diameter. Ornaments consist of ribs and riblets, about 9 to 15 in each rib space ; sometimes referred to *O. subannulare.* Greatest diameter, 2 inches. Leintwardine, Elton. Wenlock to Ludlow.

Fig. 511.—*O. originale.* Remarkable for the fact that the surface of the inner and outer layers of the shell are reversed, the furrows of the one correspond with the raised lines of the other. Diameter of largest specimen 4¼ inches. Ludlow, Downton, Leintwardine. Wenlock to Ludlow.

Fig. 512.—*O filosum.* Length of body-chamber sometimes 12, diameter 3 inches. Ornaments narrow riblets, about 120 in the circumference, with no intermediate lines ; siphuncle central. Length sometimes over 2 feet. Wenlock to U. Ludlow.

Fig. 513.—*O. imbricatum.* Body chamber sometimes 4½ inches long. Septa undulating. Distance of siphuncle from centre variable. The septal bodies (Pl. xxii, fig. 799) with a band connecting the siphuncle with the surface, supposed to belong to *O. bullatum*, should probably be referred to this. Figured from Mr. Cocking's specimen. Wenlock to Passage Beds.

Fig. 514.—*O. Mocktreense.*—The specimen figured, although corresponding with that in Murchison's Siluria, and accordingly named *O. Mocktreense*, may possibly be *O. Ludense* or *O. Saturni.* Ornaments upwardly imbricating lines, with finer intermediate ones. Siphuncle bulbous. Length of largest 12¾, diameter 3½ inches. See Pl. xxii, fig. 798.

Fig. 515.—*O. distans.* Septa more remote than half the diameter. Siphuncle more or less bulbous, eccentric ; greatest known length 8 inches. Resembles, but not identical with, *O. Ludense.* Aymestry. Wenlock to U. Ludlow.

Fig. 516.—*O. subundulatum.* Ornaments well marked upward imbrications, undulating, slightly oblique, about 4 per line ; septa direct, distance ⅛th of diameter, not parallel to the septa. Caradoc to U. Ludlow.

Fig. 517.—*O. recticinctum.* Ornaments sharp transverse riblets, sometimes slightly undulating, about 7-10 per line; septa direct, less than ¼th the diameter apart. Distinguished from the preceding by its ornaments. Figured from a specimen in Ludlow Museum. Llandovery to U. Ludlow.

Figs. 518-20.—*O. Ludense.* Body-chamber sometimes 7 inches long. Aperture with undulating outline; septa usually direct, sometimes slightly undulating; surface smooth; siphuncle central. The total length probably attained 4 feet 7 inches. Differs from *O. gregarium* in its more remote, and from *O. primævum* and *O. distans* in its closer septa. Llandovery to U. Ludlow.

Fig. 521.—*O. bullatum.* Section circular; length of body chamber about twice its basal diameter; ornaments numerous longitudinal riblets, about 7 per line; septa direct, sometimes undulating; body chamber frequently pierced by parasites. Distinguished from *O. filosum* by the fineness of the riblets, and from *O. imbricatum*, which is smooth and has an elliptic section. Wenlock to Tile Stones.

Fig. 522.—*O. gregarium.* Septa direct, distance about ¼-⅛ the diameter; siphuncle small and central; greatest known length 4 inches, diameter 10 lines. Caradoc to L. Ludlow.

Fig. 523.—*O Barrandei.* Sometimes taken for a *Gomphoceras.* Ornaments, fine lines parallel to the septa; length of body-chamber same as diameter. Wenlock to L. Ludlow.

Fig. 524.—*O excentricum.* Septa very flat, undulating, distance ⅐ of the diameter. Greatest length 2⅜, diameter 1¼ inches. Wenlock to U. Ludlow.

Fig. 525.—*Cyrtoceras corniculum.* Surface shows fine transverse lines; body-chamber short; siphuncle probably external. Length of largest specimen 3, diameter 1⅛ inches Wenlock Shale and Limestone.

Fig. 526.—*Gomphoceras æquale.* Septa very flat, direct; siphuncle small, central. Largest shell 3 by 2 inches, but seldom more than 1 inch in diameter. Wenlock Shale and Limestone.

Figs. 527-8.—*G. corona.* Section elliptical; septa flat. Siphuncle not central. Wenlock Limestone.

Fig. 529.—*G. cinctum.* Section elliptical. Constriction round the base of the body-chamber and the aperture; septa slightly convex; siphuncle not central. Diameter of largest 2 inches. Wenlock to L. Ludlow.

Fig. 530.—*Ophidioceras (Lituites) articulatum.* Inner whorls just in contact, but the body-chamber continues straight for ⅔ the greatest diameter; symmetrical; the front has the flattened band which distinguishes this species; siphuncle nearly external. Diameter 1⅛ inches. Not uncommon at Stoke Wood. Wenlock to L. Ludlow.

Fig. 531.—*Orthoceras araneosum.* Ornaments a net-work of transverse and longitudinal raised lines, very close to each other. Transverse folds of growth are often found. Greatest diameter 3⅛ inches. Like *O. bullatum* or *O. filosum*, but these have not the net-work of ornaments of this species. Buildwas, etc. Wenlock to U. Ludlow.

Figs. 532-4.—*Phragmoceras arcuatum.* Section (fig. 533) oval, having the wider part on the convex side of the shell, and the bulbous siphuncle near the concave. The aperture (shown fig. 532, but in an inverted position), consists of a large, transversely uniform opening, situated on a prolongation of the shell; and of a small one, produced horizontally, (the left side of fig. 532 corresponds with the right of fig. 534), and these openings are connected by a nearly closed passage. Ornaments, not very regular lines of growth, curving back towards the convex side. At the base of the body-chamber is a crenulated band, (not seen in the figure). Septa direct. Greatest diameter 4 inches. Mocktree, etc. Wenlock Limestone to L. Ludlow.

Fig. 535.—*Cophinus dubius.* This curious body has the form of an inverted 4-sided pyramid, rounded off at each corner, transversely striated, presenting the appearance of basket-work, (hence the term *Cophinus*). It is generally vertical in the rock, and supposed to have been formed by the rotatory motion of the stems of encrinites, portions of which, as seen at the right of the figure, are sometimes associated with it. Drawn from a specimen lent by Mr. Cocking.

Fig. 536.—*Spongarium Edwardsii.* Corallum simple, thin, attached by a small oval space to foreign bodies, surface marked with a few radiating ridges of which some branch, while others remain simple; intervening spaces with a few irregular, concentric wrinkles. Diameter about 1 inch Whitcliffe.

Fig. 537.—Read *Pachytheca.* See Pl. xxii, figs. 817-22.

PLATE XVII.

Fig. 538.—*Protaster Miltoni.* Disc often more than 1 inch wide ; arms composed of a double row of about 40 pairs of squarish, concave plates above, placed opposite, and not alternating as in other species ; the outer margin clothed with tufts of spines. On the under surface, between the highly convex marginal plates, lies a double row of central plates of an hour-glass shape, at the extremity of which are apertures—the passages for the suckers or ambulacra. The oral pentagon is made up of 20 bones. Abundant at Leintwardine.

Fig. 539.—*P. Sedgwickii.* Disc full ¾ inch wide, and coarsely reticulate ; arms start from near the centre ; rays broad. Underbarrow, Westmoreland ; not found in Shropshire.

Fig. 540.—*P. leptosoma.* Disc very thin and scarcely visible ; rays seldom above an inch long ; the oral pentagon conspicuous and of a beautiful petaloid shape ; arms appear more slender than they really are from being convex only along the median line ; their margins can be seen only by careful examination ; plates of the lower surface 4 ; the lateral ones with short spines, the central ones are very narrow, a fact which is characteristic of this species. Leintwardine.

Fig. 541.—*Palæocoma Marstoni.* This genus differs from *Palasterina* chiefly in the elongated, narrow, ambulacral bones, and the double row of bordering plates. The shorter spines set at a wide angle from the margins of the arms distinguish *P. Marstoni* from *P. Colvini.* Mouth wide and pentagonal, with strong bordering plates. Church Hill, Leintwardine.

Fig. 542.—*P. Colvini.* In many respects like the preceding, but the length of its hair-like spines distinguishes it from this and any known species, recent or fossil. Leintwardine. Mr. Salter mentions another species which he names *P. cygnipes*, very like *P. Marstoni*, but with more slender and closely reticulate arms clothed with short spines, and with a thin, membraneous, inter-radial web. Leintwardine.

Fig. 543.—*Palasterina (Uraster*, Forbes) *primæva.* The basal or angle-ossicula are enlarged, three-cornered, and furnished with a pyramid of spines pointed inwards. The upper surface roughly tuberculated, and with tufts of short spines. Leintwardine.

Fig. 544.—Read *Palæaster hirudo.* Distinguished by its lanceolate arms. Pottersfell, Kendal. Not known in Shropshire.

Figs. 545-6, and fig. 548, (undescribed), have been drawn from specimens in Mr. Marston's collection, and in the Ludlow Museum.

Fig. 547.—*P. Ruthveni.* The upper surface of the rays and disc are reticulated and furnished apparently with tufts and spines ; the under surface exhibits a double series of ambulacral articulations. Large specimens are about 3¼ inches in diameter. Westmoreland.

Fig. 549.—*Scyphaster digitalis* (Salter ms.) Drawn from a unique specimen in the collection of Mr. A. Marston. At five points on the edge of the central disc five tubercles appear to be the basis of as many arms. What seem to be triangular flaps, alternating with the arms, may be detected in two places on the right hand side of the figure.

Figs. 550-1.—As yet undescribed ; figured from specimens in the Ludlow Museum.

Fig. 552.—*Ischadites Kœnigii.* "There is no doubt this is one of the regular sponges like *Sphærospongia* (fig. 48). It has a root, as proved by a specimen from Llangollen, and a foramen at top". Cambridge Catalogue.

Fig. 553.—*Trachyderma coriaceum.* Probably the external case or tube of a serpula. Tube flexuous (originally membraneous), transversely annulated with numerous sharp plaits. One extremity is much smoother and less bent than the other. Abberley Hills. Wenlock Edge, etc.

Fig. 554.—*T. squammosum.* Tube flexuous, transversely annulated with plaits, the ridges of which unite irregularly ; striations (apparently lines of growth) may be detected between the rings. The grey, unevenly laminated sandstone in which the specimens are found is evidence of very shallow water with a bottom of silt or fine mud.

Fig. 555.—*Tentaculites tenuis.* Nat. size and magnified. Average length 3¼ lines, girt with small narrow rings at irregular distances ; intervening spaces with finer rings. Resembles *T ornatus.* Pl. x. fig. 230.

Fig. 556.—*Homalonotus Knightii.* A species of very wide range, being found abundantly in the Upp. Ludlow Rocks of Shropshire and the border counties, in Gothland, Nova-Scotia, and South Africa. A large specimen measures 5½ inches long by 3 inches wide at the cephalic shield. *H. Ludensis* is a variety distinguished by the form of the front margin which is not sinuous and tricuspid like the above.

Fig. 557.—*Eurypterus pygmæus*. First segment very narrow; last segment elongated; telson long, triangular, slightly keeled above. Ludford Lane and Railway Cutting, Ludlow. Downton Sandstone and Passage Beds.

Fig. 558.—*E. acuminatus*. Tail joints much broader than those of *Stylonurus (Eurypterus) megalops*. Telson expanded and cordate at base; edge crenato-serrate. Downton Sandstone and Passage Beds.

Fig. 559.—*E. linearis*. Occurs in a lower stratum than the previous species. Telson linear, lanceolate, with a strong keel along the whole length; edge faintly crenate. Downton Sandstone.

Fig. 560.—Read *Stylonurus (Eurypterus) megalops*. Distinguished from *Eurypterus* by the form of carapace, the great length of telson, and the oar-like jaw-feet. Downton Sandstone and Passage Beds.

Fig. 561.—Read *S. (Eurypterus) Symondsii*. Known only from the carapace. Old Red Sandstone.

Fig. 562.—*E. Brodiei*. Drawn from the figure in the Transactions of the Woolhope Club. A specimen described by Woodward shows the existence of a swimming foot. Head semicircular; eyes subcentral. Stoke Edith, Herefordshire. Passage Beds.

Fig. 563.—*Ceratiocaris Pardoensis*. Figured from a fine specimen in the Ludlow Museum, which has, however, been made up of two others. Prof. Rupert Jones thinks that perhaps the head is that of *C. leptodactylus* or *C. inornata*, and the tail (which is reversed) that of *C. tyrannus*, Salt, or possibly *C. Ludensis*, Woodward.

Fig. 564.—*Ceratiocaris*, from Lesmahago. Drawn from a figure in Murchison's Siluria in which the abdominal part has been displaced and attached to the wrong end of the carapace.

Figs. 565-6.—*C. Murchisoni* and *C. leptodactylus*. These species of Ceratiocaris have not yet been adequately described.

Fig. 567.—*Pterygotus Ludensis*. A species resembling in many respects *P. gigas* and *P. anglicus*. Among the differences are the following:—The caudal joint is less abruptly apiculated, the antennæ have a more slender shaft, and the teeth are more conical than in *P. anglicus*, while the whole claw is much shorter than in *P. problematicus*. The figure here given is after Salter in the 3rd Ed. of Siluria. For Woodward's more correct restoration see Pl. xxiv, fig. 823. About $\frac{1}{20}$th the natural size.

Fig. 568—*P. problematicus*. "This is the principal, if not the only species in the Upper Ludlow Rock which has the usual semicircular ornamental plicæ." Woodward. Many fragments have been found at Whitcliffe, the Railway Cutting, and other places near Ludlow. From some of these it would appear to have attained a length of nearly 5 or 6 feet.

Figs. 569-70.—Read *Hemiaspis limuloides*. For description see Pl. xxii, figs. 806-7.

PLATE XVIII.

NOTE.—For the title of this Plate read HYDROZOA.

RHABDOPHORA.

Fig. 571.—*Monograptus chimæra*. Doubtfully referable to Barrande's species, from which it differs in the smaller number of hydrothecæ to the inch, in the depth of their concave edge, and in the distinct prolongation of the virgula or axis. Church Hill, Trippleton, Leintwardine.

Fig. 572.—*M. capula*. Hopk. ms. Polypary very slender, of considerable but unknown length; hydrothecæ from 18 to 20 to the inch, at an angle of about 15 degs. with axis, their outer margin free for two-thirds of its length, and slightly convex; distal end retuse with conspicuous circular aperture. Burrington. Wenlock Shale.

Fig. 573.—*M. Bohemicus*. Polypary short, curved throughout, more so towards the proximal extremity; hydrothecæ on concave side, about 20 to the inch, at an angle of 30 degs. with axis, each having the form of a conical sack widest at the outer aperture; edge of aperture straight or concave. Characteristic of Lower Ludlow rocks in Shropshire, Westmoreland, Sweden, Bohemia, and France. Elton Lane, near Ludlow.

Fig. 574.—*M. Leintwardinensis*. Polypary short and stout; greatest length ¼ inch; virgula distally prolonged; hydrothecæ at an angle of 40 degs. with axis, overlapping, prolonged into spines from the upper angle of the ventral margin of the thecæ. Ludlow, Trippleton, Church Hill, Leintwardine.

Fig. 575.—*M. clavicula*. Hopk. ms. Polypary very slender, length unknown; hydrothecæ about 20 to the inch, at an angle of about 10 degs. with axis, their outer margin nearly free, at first convex, then concave. Church Hill and Trippleton Lane, Leintwardine.

Fig. 576.—*M. Nilssoni*. Polypary several inches long; the distinctive characteristics are (1), the concave curvature and invariable diameter ($\frac{1}{30}$th of an inch) of the adult polypary, and (2), the triangular shape of the compressed hydrothecæ with their apertural margin at right angles to the line of the virgula. In *M. intermedius* the hydrothecæ are arranged on the convex margin. Trippleton, Church Hill, Elton Lane, Stanner Hall.

Fig. 577.—*M. colonus*. The greatly prolonged virgula and closely set hydrothecæ distinguish the British form which is generally referred to this species. It rarely exceeds about an inch in length. Elton Lane, Evenhay, Mary Knowle.

Fig. 578.—*M. Rœmeri*. Polypary short, stout, straight, from $\frac{1}{2}$ to 1 inch in length; hydrothecæ long narrow tubes without spines, attaining a length of $\frac{1}{8}$th inch, 30 to the inch, inclined at an angle of 30 degs. with the axis. Adforton, Elton Lane.

Fig. 579.—Read *M. retusus*. Hopk. ms. Polypary about an inch long, including distal prolongation of virgula for $\frac{1}{4}$ inch; hydrothecæ about 35 to the inch, at an angle of 30 degs. with axis, outer margin free, at first slightly concave, then convex. Stanner Hall, Trippleton Lane.

Fig. 580.—*Cyrtograptus Ludensis*. Hopk. ms. Polypary slender, with a strong outward curvature; branches springing from modified hydrothecæ; hydrothecæ about 20 to the inch, at an angle of about 45 degs. with axis, their outer margin almost free, at first convex, then very concave. Teme Side.

CLADOPHORA.

Fig. 581.—*Ptilograptus elegans*. Hopk. ms. Polypary very slender, irregularly branched; branches straight, forming a small angle with each other; branchlets alternate, at an angle of 30 degs. with the branches, about $\frac{1}{35}$th inch apart, $\frac{1}{5}$th in length, with from 60 to 80 pointed hydrothecæ to the inch. Bow Bridge. Lower Ludlow.

Fig. 582.—*Callograptus Ludensis*. Hopk. ms. Polypary flabelliform; branches flexuous, very tenuous, bifurcating and anastomosing irregularly, diverging at first but soon becoming parallel. (The graptolite is not, as the figure would indicate, free, but imbedded in the shale.) Burrington. Wenlock Shale?

Besides the above Graptolites Mr. Hopkinson has collected the following:—*Monograptus Salweyi*. Stanner Hall, Leintwardine. *Dendrograptus Nicholsoni*. Bow Bridge. *Ptilograptus anglicus*. Bow Bridge.

Fig. 583.—*Discina striata*. Apex undefined; surface marked with numerous fine, radiating striæ which increase in number as they approach the margin, crossed by concentric lines of growth. Lower, or perforated valve, flattened; slit oval, rather wide. Length 7, width 8 lines. Delbury.

Fig. 584.—*Lingula cornea*, Oblong, sub-pentagonal; sides parallel; beak obtusely angular; valves covered with undulating lines of growth. A large, more oblong, and rectangularly shaped shell than the *L. minima* of the Downton-sandstone, with which it has been confounded. Length 7, width 5 lines. Passage beds of Tin Mills and of Railway Cutting, Ludlow; Onibury.

Figs. 585-.6—*L. lata*. Sides slightly convex; beaks obtusely angular; front gently rounded, surface covered with fine concentric lines. Length 3, width 2 lines. Vinnals, Elton, Mocktree, Stoke Wood, &c.

Figs. 587-8—*L. minima*. Small, oblong; sides curved; beaks acuminate; front rounded; valves marked with fine concentric striæ. Length 4, width 2½ lines. Plentiful in Downton sandstone at Norton, Ludlow, &c.

Figs 589-90.—Read *Glassia obovata*. Almost circular; valves nearly equally convex, sometimes with fold in front of the dorsal, and depression in the ventral valve; beak small, incurved; surface smooth or with slight concentric lines. Length 5, width 5½ lines. West flank of Malverns.

Figs. 591-4.—*Orthis lunata*. Nearly obicular; hinge line straight, less than the width of the shell; valves moderately convex; widest anteriorly; beak small; dorsal valve (fig. 593) with mesial depression; interior of ventral valve (fig. 594) with saucer-shaped depression. Distinguished from allied forms by the fineness of the striæ, the near equality of the valves, and the narrow, elongated, muscular impressions. Length 4, width 6 lines. Abberley, Whitcliffe, &c.

Figs. 595-7.—*O. canaliculata* Transversely oval; hinge line shorter than the width of the shell; dorsal valve with moderately deep sinus; ventral, convex; beak small and incurved; surface marked with numerous radiating, bifurcated, and interpolated ribs. Length 6, width 7 lines. Distinguished from *O. elegantula* by its deeper sinus and its valves not tapering anteriorly,

Fig. 598.—*Strophomena ornatella*. Semicircular, broadest at hinge line; ends of hinge pointed, forming small mucronate wings. Ventral valve slightly convex; dorsal, almost flat. Surface marked with radiating thread-like ribs; interspaces occupied by two or three smaller ribs. Length 7, width 9 lines. This species has been mistaken for the young *S. filosa*; but its sculpture and internal muscular impressions are different; it is also a much smaller species. Its casts abound on Whitcliffe, Ludlow.

Figs. 599-600.—*Chonetes lepisma*. Shell small, semi-circular, wider than long. Hinge line shorter than the width of the shell. Ventral valve evenly convex; dorsal, concave; surface smooth, glistening and marked by a few concentric lines of growth. Along the hinge line are six tubular spines. Length 4, width 5 lines. Aymestry. Lower Ludlow.

Figs. 601-2.—*Avicula Danbyi*. Hinge-line rather less than half the width of the shell. Posterior wing scarcely twice the length of the anterior; both wings nearly rectangular, with slightly concave margins, left valve (fig. 601), gently convex, with radiating ridges: right valve flat without radiating ridges. Stoke Wood.

Fig. 603.—*Pterinea rectangularis*. A variety of *P. retroflexa*. Norton.

Fig. 604—*P. Sowerbyi*. Posterior wing gently arched, scarcely extending beyond the shell, its posterior edge slightly concave. Length from beak to respiratory angle 2⅓ inches; width from middle of hinge line to ventral margin 1 inch. Wenlock to Ludlow.

Fig. 605.—*Anodontopsis bulla*. Orbicular, evenly gibbous; beaks very small, ⅓ the length from the anterior end; surface with a few concentric marks of growth; one small cardinal tooth beneath the beak, and a lateral one on each side of it. Width 5 lines, length 5⅓ lines. Llandovery and Ludlow.

Fig. 606.—*Ctenodonta varicosa* (*Nucula lævata*) Ovato-rhomboidal; beaks large; anterior end broadly rounded; posterior, narrow; surface marked with small concentric ridges; teeth rather large; a small cartilage pit separates the anterior from the posterior; teeth 6 or 7 behind the beaks, adductor impressions moderately strong; length 4¼ lines. Caradoc.

Figs. 607—*C. (Nucula) anglica*. Ovate; beaks large, obtuse, very prominent; anterior side short; posterior end narrow; adductor impressions very strong; hinge teeth long, 8-9, behind the beak, 7-8 in front of it; large cartilage pit beneath the beak; surface smooth, with fine concentric lines. Length 5⅓ lines. Llandovery to Ludlow.

Fig. 608.—*Cucullella antiqua*. Subquadrate; ventral margin nearly parallel with hinge line; anterior end large, rounded; clavicular ridge thick, slightly oblique; numerous minute teeth on the hinge-line; average length 3½ lines. Distinguished from *C. ovata* by its smaller size, more quadrate form, longer hinge line, and wider posterior end. Caradoc (?) to Ludlow.

Fig. 609.—Read *Redonia (Cucullella ?) anglica*. Shell transversely oval, half-an-inch wide and one-third long; beak curved and sharp, overhanging the lunette; in front of beak occurs a thick curved plate, obliquely reaching half way down the anterior side. Llandeilo.

Fig. 610.—*Cucullella Cawdori*. Transversely elliptical; posteriorly truncated; a ridge extends from the beak to the posterior angle of the margin. Length 4, width 7 lines.

Fig. 611.—*C. ovata*. Gibbous; hinge-line with numerous fine teeth; clavicular ridge extending more than half way from the beak to the ventral margin; surface with minute concentric lines. Average length nearly 1 inch. Llandovery and Ludlow.

Fig. 612.—*Orthonota angulifera*. Beaks small, half the width from the anterior end; a strong ridge runs from the beak to the inferior, posterior angle; posterior slope divided into three broad radiations by shallow impressed lines crossed by wrinkles. Length 1⅓ inch.

Fig. 613.—*O.* (*Modiolopsis* McCoy) *solenoides*. Subcylindrical; an obtuse ridge extends from the beak to the posterior inferior angle: hinge-line not elevated. Length 1¼ inch. Distinquished from *M. complanata* by its greater length, depressed hinge-line, the obliquely truncated posterior end, and greater convexity.

Fig. 614.—*O. rigida*. Nearly four times as wide as long, with 12-18 concentric folds; beaks at the anterior sixth or seventh. Llandovery and Ludlow.

Figs. 615-7.—*O. amygdalina.* Beaks very large, near the anterior end which is sub-truncated with a deep cordate lunette below; ventral margin with a faint concavity; hinge-line not elevated, nearly at right angles to the plane of the valves. Very variable in its proportions; younger specimens short and subtrigonal. Ludlow, Stoke Wood. Llandovery and Ludlow.

Fig. 618.—*O. prora.* Beaks prominent; anterior end compressed; surface with fine concentric lines. length 1½ inch Resembles *Grammysia triangulata* in the wrinkling of the anterior side, but differs in its being more angulated, and in the absence of the sulci from the beak.

Fig. 619.—*O. undata.* Beaks large, obtuse; anterior lunette deep; ventral margin with strong sinus from which a deep depression extends towards the beak; surface marked with strong ridges, the strongest on the anterior end. Stoke Wood Wenlock (?) to Ludlow.

Fig. 620.—*O. rotundata.* Beaks obtuse; two shallow furrows from the beak to the ventral margin; the right valve has but one faint furrow; surface with small concentric undulations. Length 1½ inches. The existence of the two obtuse furrows shows an affinity to *Grammysia*, otherwise the general form of the shell resembles *Orthonota.* Llandovery and Ludlow.

Fig. 621.—*O. impressa.* Elongate; beaks large, broad; lunette deep, ovate, large; anterior end small, rounded; posterior end obliquely truncated; hinge line long, straight, not elevated; a shallow sinus in the ventral margin; anterior end and sides marked with obtuse irregular plicæ. Stoke Wood. Llandovery and Ludlow.

Fig. 622.—*Modiolopsis platyphyllvs.* Anterior lobe very large, defined by a very wide, shallow sinus in the middle of the ventral margin; surface nearly smooth. Length 2 inches. Distinguished from *M. modiolaris* by the less convex valves, the large anterior side, and the posterior ventral sinus.

Fig. 623.—*M. complanata.* Oblong; beaks small; an obtuse ridge extends from the beak to the posterior, inferior angle; surface with small concentric lines. Length 1, width ½ inch.

Fig. 624.—*M. lævis.* Transversely elongated; smooth; anterior side small; posterior large; edge nearly straight and oblique. Length 9, width 15 lines.

Fig. 625.—*Grammysia triangulata.* Ovate or subtriangular; beaks large; left valve with two ridges from beak to margin either defined by three sulci, or one between them; one strong corresponding sulcus in the right valve; the obliquity of these sulci varies considerably. Length 1¾ inch.

Fig. 626.—*G. cymbæformis.* Rhomboidal; valves very deep and strongly keeled; beaks small, incurved. Length 1-1½ inch. Onibury, Stoke Wood. Llandovery and Ludlow.

Fig. 627.—Drawn from a specimen in Ludlow museum. Probably a species of *Cardiola.*

Fig. 628.—Read *Cyclonema (Litorina) corallii.* Ovate, pointed; spine of 5 slightly flattened whorls, with fine, close spiral striæ, 2 larger than the rest on the body whorl; mouth broad, ovate. Length 5 lines. Usually imbedded in the coral *Monticulipora fibrosa.*

Fig. 629.—Read *Cyclonema (Litorina) octavia.* Ovate, pointed; about three fine spiral ridges on each whorl, to which 3-4 closer ones are added on the base of the body-whorl, crossed by fine, oblique lines of growth. Length 7 lines. N.B.—The transverse striæ in the figure are too coarse and far apart. Brockton, near Wenlock.

Fig. 630.—Read *Cyclonema cirrhosa.* Conical, turreted; whorls few, longitudinally grooved; aperture round; umbilicus open. Length 27, diameter at base 16 lines. Wenlock.

Fig. 631.—Read *Cyclonema Williamsi.* Obtusely trochiform; about 4 convex whorls; base rounded; umbilicus narrow, deep; mouth oblique, ovate. Width 1½ inch.

Fig. 632.—*Pleurotomaria ? undata.* Conical with convex base, obtuse; whorls about 4, very convex, crossed by many oblique waves; sinus in the lip deep, forming a slight band round the whorls.

Fig. 633.—*Euomphalus carinatus.* Discoid, with a broad sharp keel round margin; whorls few, with many concentric ridges crossed by sharp lines of growth. Diameter nearly 3 inches. Aymestry.

Fig. 634.—*Murchisonia corallii* (*Pleurotoma* Sil. Sys.) Turreted, smooth; whorls 8-10; a narrow band below the middle of the whorl. Length 6½, width 3 lines. Botville, Stoke Wood.

Fig. 635.—*M. articulata.* Turreted, nearly smooth; whorls 8-10, very convex, giving the spire the appearance of a row of beads; a broad band in the middle of the whorl. Length 10½, width 3½ lines. Llandovery and Ludlow.

Fig. 636.—*Natica parva*. Sub-hemispherical, smooth ; spire flat, of about 1 whorl ; aperture very large. Diameter 4½, height 3 lines.

Fig. 637.—*Loxonema* (*Terebra* Sil. Sys.) *sinuosa*. Turreted; whorls numerous, marked with sharp lines of growth ; a wide shallow sinus in the edge of the lip. Length 15, diameter 5 lines. Stoke Wood. Llandovery and Ludlow.

Fig 638.—*Platyschisma* (*Trochus*) *helicites*. Discoid, depressed ; spire of four gradually increasing whorls. Surface nearly smooth, crossed by fine striæ of growth; width 8 lines. Abundant at Ludlow, Downton, and Norton, in a bed about a yard above the Bone-bed. Llandeilo to Ludlow.

Fig. 639.—*Cyrtolites* (*Ecculiomphalus ?*) *lævis*. Elongated, pointed, compressed ; smooth, or only marked with lines of growth. Length 1½ inch. Stoke Wood, Abberley, &c. Llandovery and Ludlow.

PLATE XIX.

Fig. 641.—*Bellerophon carinatus*. Identical, according to Mc Coy, with *B. acutus*, Pl. v., fig. 98, which see. Caradoc to Ludlow.

Fig. 642.—*B. Murchisoni*. Involute, subcompressed, rapidly increasing ; sides very convex ; umbilicus small ; surface with fine transverse striæ. Average diameter 5 lines.

Figs. 643-4.—*B. expansus*. Known only from internal casts ; umbilicus small ; mouth large, transversely elliptical, bilobed by a V-shaped sinus ; surface with lateral wrinkles arching outwards from the umbilicus. In old specimens the apex of the V-shaped sinus is continued in a long narrow slit. About 9 lines long. Llandovery and Ludlow.

Fig. 645.—*Euomphalus alatus*. See Pl. xiv, fig. 487.

Fig. 646.—*Orthoceras undulocinctum*. Distinguished from *O. recticinctum* by the riblet ornaments which are oblique and cross the septa. Septa ¼ diameter apart. Greatest diameter 1 inch. Aymestry, Ludlow.

Fig. 647.—*O. semipartitum*. Shell very small ; greatest diameter ½ inch. The row of projections on the side are not, as has been supposed, the traces of a siphuncle, but of a plate, or perhaps two, which diverged from the interior towards the surface ; analagous probably to the flat band observed on the casts of septa of *O. imbricatum* (Pl. xxii, fig. 799). U. Ludlow, Tilestones.

Fig. 648. *O dimidiatum*. Ornaments consist of imbrications, some upward, others downward, passing obliquely half across the shell ; distance of septa varies from ⅓ to ½ the diameter ; greatest length 3 inches, diameter 4 lines. Leintwardine. Wenlock to U. Ludlow.

Fig. 649.—*O. perversum*. Section elliptic ; siphuncle unsymmetrically situated, which peculiarity seems to separate the species from *O. imbricatum* ; moreover, the rate of increase and the irregularity of undnlations of the septa is greater. Greatest diameter, 1½ inches. Ludlow. Wenlock Limestone to U. Ludlow.

Figs. 650-1.—*O. Saturni*. Ornaments consist, 1st, of irregular transverse lines, with a curious zig-zag course, not shown in the figure, 2nd, of feeble longitudinal lines, and lastly, of a number of small pits between the others of an elliptic shape, of which a magnified figure in given (fig. 651). Septa more or less oblique, greatest diameter 2 inches. Leintwardine, Mocktree, Caradoc (?) to U. Ludlow.

Fig. 652.—*Cyrtoceras compressum*. Body chamber as long as its basal diameter ; ornaments transverse, sharp, rather sigmoid lines of growth, cutting the sutures; septa occasionally very close ; siphuncle external and bulbous ; curved length 4½ inches. Aymestry, Leintwardine, Stoke Wood, Ludlow. Llandovery to U. Ludlow.

Fig. 653.—*C. extricatum*. Section circular ; aperture without constriction though the body-chamber decreases in diameter towards it ; septa parallel to the ribs ; siphuncle small and nearly central. Length 2½ inches. Mocktree, Aymestry.

Fig. 654.—*C. intermedium*. Section a flattened oval. Length of body-chamber ¾ of its basal diameter; sutures sigmoidal ; siphuncle probably minute and external. Greatest diameter 1½ inches. Leintwardine. Wenlock (?) to L. Ludlow.

Figs 655-6.—*Gomphoceras ellipticum*. Transverse section elliptical ; aperture bounded by a broad depression (fig. 655). Ventral side showing lines of growth below and portion of aperture above. Fig. 656 shows shape of aperture. Differs from *G. pyriforme* in both its sections. Length about 3 inches. Leintwardine.

Fig. 717.—*Spirifer trigonalis.* Extremely variable in form and the number of ribs. In its most simple shape the sinus presents 3 ribs, of which the central is the largest; in larger individuals these are sometimes increased to 7; surface covered with fine striæ, and closely imbricated by numerous fine, serrated ridges.

Fig. 718.—*S. glabra.* Although the typical form possesses smooth valves, indications of lateral plication or slightly rounded ribs are often found, the fold and sinus remaining always smooth.

Fig. 719.—*Goniatites crenistria.* Nearly allied to the Ammonite from which it differs in having the septa free from crenatures, so that their outline is angular and uninterrupted. Carboniferous Limestone.

Fig. 720.—*Terebratula hastata.* The largest British carboniferous Terebratula known, some specimens being 26 lines long and 19 broad. Often found with coloured stripes like those on the living shell.

Fig. 721.—A palatal tooth adapted for crushing shells, belonging possibly to *Orodus ramosus,* a fish of the division *Cestraphori,* suborder *Plagiostomi.* Farlow.

PLATE XXI.

Fig. 722.—*Loxomma.* The fine head here figured, which is the property of G. Maw, Esq. of Benthall Hall, is the only *English,* and the only perfect specimen known, those from Edinburgh having the orbital ridge imperfect; it was found near Dawley, in the ironstone measures of the coal-field.

Figs. 723-4.—*Rhynchosaurus.* Fig. 723, from the specimen in the Shrewsbury Museum. Fig. 724, foot print from a slab in the possession of C. Kilvert, Esq., of Grinshill, at which place the remains of this remarkable animal are found, associated with the impression of raindrops and ripple-marks. Trias.

Fig. 726.—*Stricklandinia lens.* This figure and the next are drawn from specimens in the possession of Mr. Phillip. For description of species see Pl. vi, fig. 133. Norbury.

Fig. 727.—*Triplesia* (*Orthis*) *insularis.* Transversely oval; ventral valve convex with deep sinus; beak small; dorsal valve very gibbous; umbonal beak large; a rounded mesial fold extends from the umbone to the front; surface smooth. Length 12, width 18 lines. Minsterley. Llandeilo to Llandovery.

Figs. 728-9.—*Rhynchonella Llandoveriana.* Transversely rhomboidal. Ventral and dorsal valves moderately convex; beak small, incurved; fold and sinus broad, occupied by 7 or 8 ribs. Length 6-7, width 7-9 lines. Minsterley. Llandovery.

Figs. 730-2—*Leptæna scissa.* Semicircular; ventral valve gibbous; dorsal, concave; fissure covered by a pseudo-deltidium; surface ornamented with 4-5 radii with striated interspaces. Length 2, width 4 lines. Drawn from Mr. Phillip's specimens. Minsterley. Caradoc to Llandovery.

Fig. 733.—*Strophomena antiquata.* Variable. Ventral valve slightly concave; dorsal, convex, with mesial fold. Surface with coarse, often waving radii, crossed by imbricated lines of growth. Length 14, width 19 lines. Caradoc (?) to Wenlock.

Fig. 734.—*Atrypa* (*Retzia*) *Barrandei.* Ventral valve convex; beak small, incurved, with foramen; surface with 6 large rounded ribs; dorsal valve almost flat or even depressed anteriorly; marked by 7 ribs. Length 4-3½, width 4-3 lines. The arrangement of its internal spires similar to that of *Atrypa.* Wenlock.

Figs. 735-8.—Read *Waldheimia bicarinata.* Angelin. (*Mawii.* Dav.) Dorsal valve with a small median rib; ventral, very convex, keeled; surface smooth. Found by Mr Maw in great numbers in his washings of the Wenlock shales of Tickwood, Farley Dingle, and below the Limestone, Benthall Edge. Length 2, breadth 1½ lines. Fig. 738, interior as developed by Mr. Glass. Wenlock.

Figs. 739-41.—*Glassia elongata.* Resembles *Athyris læviuscula* (figs. 419-21) but is broader and flatter in proportion; spirals similar to those of *G. obovata.* Length 4, width 3 lines. Benthall Edge. Wenlock.

Figs. 742-3.—*Atrypa Mawii.* Valves moderately convex, the dorsal has a slight longitudinal groove. Only one specimen known. Benthall Edge. Wenlock.

Figs. 744-7.—*Glassia obovata.* For the interesting account of the discovery and developement of this shell by Messrs. Maw and Glass, see Davidson's supplement to Brit. Brachiopoda,

p. 116. Fig. 747 exhibits the curious spirals in the dorsal valve. The genus *Glassia* belongs to the family *Atrypidæ*, though the coils are directed differently. Size rarely 5 lines long, by 6 lines broad. Benthall Edge, Buildwas. Wenlock.

Fig. 748.—*Atrypa reticularis*. For external characters see Pl. vi, fig. 135. Fig. 748, internal coils and their attachments as developed by Mr. Glass. The shell varies considerably with age in form, in the number of ribs, and of the internal coils. The size varies from ¼ line up to 1½ inch.

Figs. 749-51.—*Dayia navicula*, 2¼. Formerly *Rhynchonella navicula*, but changed to this new genus from a fuller acquaintance with its internal structure (fig. 751). For description see Pl. xii, fig. 350.

Fig. 752.—*Whitfieldia tumida*. Also removed from the genus *Atrypa* and *Meristella*, where it had formerly been placed, to the present one. Observe the forked termination of the central vertical process: in *Meristella* the branches form complete loops. The existence of *Meristella* in Britain is very doubtful. For external character, etc., see figs. 408-13.

Figs. 753-4.—*Atrypa asperula*. Differs from *A. reticularis* in its few, persistent, scabrous ribs. Length 5, breadth 6 lines. Abundant in the Limestone of Benthall Edge. Wenlock.

Fig. 755.—The "shoe lifter" process of *Merista Herculea*, characteristic of this genus: here figured for comparison with *Meristella Circe* (Pl. xiii, fig. 416-18), which may belong to it. The loops of the lamellæ resemble those in *Meristella*.

Fig. 756.—*Strophomena Llandeiloensis*. Hinge-line full width of shell, extremities angular. Ventral valve convex; dorsal, concave. Length 12, width 13 lines. Possibly a variety of *S. compressa* (fig. 121), but more semicircular and lengthened. Figured from Mr. Phillip's specimen. Llandeilo.

Figs. 757-8 —Figured from specimens in the cabinet of Mr. Phillip. Minsterley.

Fig. 759.—*Conularia bifasciata*. Undescribed. Figured from a specimen in the Ludlow Museum. L. Ludlow.

Fig. 760.—*Orthoceras Nicholianum*. Ornaments transverse, sharp, slightly oblique ribs, crossed by sharp longitudinal lines, more numerous than the ribs, with much finer lines in the interspaces. Figured from Mr. E. Levy's specimen. Stoke Wood. Llandovery to L. Ludlow.

Fig. 761.—*O. Avelinii*. Figured from a specimen in the possession of Mr. Phillip. Speak's Rough, near Minsterley. See also Pl. ii, fig. 26. Llandeilo.

Figs. 762-5.—*Diagram of a Trilobite*, Fig. 762 shows the central "glabella" bounded by axal furrows on each side, and the neck furrow below. The sides or "cheeks" consist of two portions, one of which is united to the glabella, and the other, which bears the eye, is separated by the "facial suture." The posterior angles of this portion are often produced into spines. A plate (see fig. 284), which protects the under-surface of the head, is called the "labrum." Figs. 763-4, thorax rings or segments, consisting of (1), a central axis, and (2), side-lobes or "pleuræ." The dark parts on each side of the latter indicate smooth portions or facets which enabled the animal to roll itself up. Fig. 765, the tail or "pygidium," consisting of an axis and the lateral portions or "limbs," which are either entire, as seen on the left of the figure, or composed of pleuræ, united by sutures, on the right of it; this is also facetted anteriorly.

Fig. 766.—Section of head of *Rhynchosaurus*, showing the arrangement of the bones of the skull. Grinshill Quarries. Figured from a unique specimen in the British Museum, Cromwell Road.

PLATE XXII.

Fig. 767.—*Ctenodonta* (*Arca*) *obliqua*. Shell obliquely and transversely oval, rounded anteriorly, obliquely truncated posteriorly; hinge-line straight; teeth strongly marked posteriorly and oblique to the hinge-line. Caradoc.

Fig. 768.—*Orthonota nasuta*. Shell elongate, narrow, sub-cylindrical, convex; dorsal and ventral margins sub-parallel; umbones moderate; posterior end obliquely truncate; surface with faint concentric lines of growth. Caradoc.

Figs. 769-74.—*Orthis calligramma*, see Pl. iv fig. 81. Figs. 775-7, *O. Actoniæ*, see Pl. iv. fig. 86. Fig. 778, *O. porcata*, see Pl. iv. fig. 82. Fig. 779, *O. flabellulum*, see Pl. iv. fig 80. Figs. 780-3, *Leptæna transversalis*, see Pl. vi. fig. 117.

Fig. 784.—*Leptæna segmentum.* A smaller, less convex, and more spindle-shaped species than *L. transversalis*; the radii which ornament the valves are less numerous and are much wider apart; its interior structure is also very different. Length 3, width 5 lines. Buildwas. Wenlock.

Fig. 785.—*L. quinquecostata.* Resembles the preceding, but the principal radii are four, seldom exceeding five, its beak also is larger and more projecting; its muscular impressions are shorter than those of *L. sericea.* Length 3, width 6 lines. Llandeilo to Llandovery.

Figs. 786-9.—*Orthis testudinaria,* see Pl. iv. fig. 77. Figs. 790-2, *Rhynchonella nucula,* see Pl. vi. figs. 143-5. Figs. 793-7, Read *Orthis elegantula,* see Pl. iv. fig. 78. Fig. 798, *Orthoceras Mocktreense,* see Pl. xv. fig. 514. Fig. 799, *Orthoceras imbricatum,* see Pl. xv. fig. 513.

Fig. 800.—*Bryograptus Callavei.* Polypary branched at a small angle; secondary branches upon inner margin; hydrothecæ about 20 to the inch, long and slender, with acuminate denticle. Shineton, Cound brook. Resembles the species described in the Norwegian beds of the Upper Cambrian.

Figs. 801-4.—*Leperditia gracilenta.* A bivalve crustacean of the order *Ostracoda.* Described by Prof. Rupert Jones (Ann. Nat. Hist, 5th series, vol. 8, p. 339), as a small, narrow, and very oblique variety of *L. Hisingeri,* a form closely allied to *Hisinger's L. phaseolus.* Traces of the eye, muscular spots and a "nuchal" furrow, should be looked for. Ludlow Passage-beds, Tin-mill Shales, Downton Sandstone.

Fig. 805.—*Lithodomus borings.* Figured from a specimen in the British Museum, Cromwell Road, presented by Professor Corfield, and found by him in the Aymestry Limestone of Weo Edge, Stokesay. The existence of these rock-boring molluscs had not previously been known earlier than the Carboniferous period. The coral, into which the bivalve (of which a section is seen in the specimen) has burrowed, is a *Heliolites.*

Fig. 806.—*Hemiaspis limuloides.* A form separated from the *Limuli,* etc., by the cephalic, thoracic and abdominal divisions remaining distinct, and constituting a link between the *Xiphosura* and the *Eurypterida.* Traces of a facial suture, as in the *Trilobites,* have been observed. Leintwardine. Ludlow.

Fig. 807.—*H. Salweyi.* Only known by the head-shields, they are very tumid and nearly circular. Ludlow.

Figs. 808-13.—Diagrams copied from Professor Lankester's monograph of the Red Sandstone Fishes, illustrating his classification of the family *Cephalaspidæ.* See p. 54.

Figs. 814-5.—*Pterichthys macrocephalus.* The smallest example known of this genus. Length 1 inch, of which the head occupies $\frac{2}{5}$ths. Allied to *Pt. hydrocephalus* of the Dura Den species, which are again longer than any previously known. Fig. 814 dorsal, fig. 815 ventral aspect of specimens found at Farlow. See Lyell's "Students' Elements," p. 427.

Fig. 816.—Read *Ceratiocaris (Physocaris?) vesica.* Figured from a specimen, the property of Mr. T. Salwey, in the Ludlow Museum. Ludlow.

Figs. 817-22.—*Pachytheca.* This interesting organism, which in Murchison's Siluria was supposed to belong to the *Lycopodiaciæ* (see fig. 537), is thus described by Sir J. Hooker:—"A confervoid alga, forming a hollow sphere, $\frac{1}{3}$ to $\frac{1}{6}$ inch, or less, in diameter; cortical portion thick, formed of densely-packed, radiating, jointed filaments, $\frac{1}{1000}$ of an inch in diameter, terminating towards the central cavity in irregularly disposed, oblong cells, of much greater diameter than the filaments. Central cavity variable in size, greater or less in diameter than the thickness of the cortex; loosely traversed by jointed, unbranched filaments, about $\frac{1}{1000}$ of an inch in diameter, resembling those of an *Œdogonium.*" Downton Sandstone. Fig. 817, natural size. Fig. 818, highly magnified. Fig. 819, the oblong cells of the radiate, cortical portion. Fig. 820, the jointed, radiating filaments of the same. Fig. 821, the *Œdogonium*-like filaments which occupy the central space. Fig. 822, section of the same.

Fig. 823.—Diagram of *Pterygotus* as restored by Woodward. Ventral aspect; $\frac{1}{20}$ th. the natural size.

INDEX TO PARTS I. AND II.

NOTE.—The names of fossils are printed in italics.

Abberley - 17
Acidaspis - 25
Acton Burnell - 13
Acton Scott - 13, 22
Æglina mirabilis - 20
Alberbury - 17
Arenicola didyma - 11
Arenig formation - 12
,, rocks of - 20, 21
Asaphus tyrannus - 21
Ashes Valley - 11, 21
Auchenaspis Salteri - 26
Aymestry Limestone - 15, 24, 25, 27, 28

Barrow - 17
Batchcott - 27
Benthall Edge - 15, 19
Beyrichia - 26
Billingsley - 17
Black Hill - 25
Bog Mine - 12, 14, 20
Bone Bed (Upper Ludlow) - 16, 24, 27
,, Well - 28
Botville - 22
Brampton Brian Park - 25
Breidden Hills - 12
Bringewood Chase - 28
Brockton - 22
Broken Stones - 23
Bromfield - 26
Broomcroft - 13
Broome - 22
Broseley - 17
Buildwas - 19
Bull Hill Cottage - 11
Burrington - 27

Callaway, Dr. - 10, 11, 13, 20, 24
Cambrian Series - 10
,, ,, rocks of - 12, 22, 23
Caradoc, Caer - 10, 22
,, (or Bala) formation - 12
,, ,, rocks of - 22, 23
Carboniferous Series - 17
Cardington - 19
Carwood - 13
Cephalaspis ornatus - 26
,, *Murchisoni* - 26
Ceratiocaris - 26, 27
Charnwood Forest - 10
Chatwall - 13, 22
Cheirurus Sedgwickii - 20
Cheney Longville - 13
,, ,, Flags - 13
Chirbury - 12
Church Hill - 27
Churchstoke - 12
Clee Hills - 16, 17, 28
Clun - 25
,, Forest - 16
Clunbury Hill - 25
Coal Measures - 10, 16, 17
Coal Fields - 17
Cocking, Mr. - 26
Corndon - 20
Corston - 12
,, Grit - 22, 23, 25
Cound Brook - 13
Craven Arms - 15, 23
Criggion - 17
Crinoids - 27
Cwm Head - 23

Darwin, Mr. - 16
Dawley - 17
Dictyonema sociale - 11
Didymograptus pristis - 22
Dinchope - 24
Disgwylfa - 12
Dolmens - 25
Downton - 15, 16
,, Sandstone - 16, 24, 26
Dryton - 11
Dunge House - 20

Easthope - 22
Eaton Constantine - 11
Elton Lane - 28
Enchmarsh - 13
Encrinurus punctatus - 26
Ercall Hill - 10
Euomphalus - 25
Eurypterus - 24
,, *acuminatus* - 26
,, *pygmæus* - 26
Evenhay - 28
Evenwood - 13

Farley Dingle - 19
Farlow - 16, 28
Frodesley - 13

Garmston - 11
Gittens Hay - 11
Gomphoceras Bohemicum - 24
Graptolites - 23
Grinnell's Cross. - 24
Grinshill - 18

Habberley - 11
Halford - 24
Harley - 13, 19
Hatton - 13
Haughmond Hill - 10
Hazlar - 10,22
Helmeth - 10
High Vinnalls - 28
Hill Halton - 26
Hoar Edge - 11, 13, 22
Holt - 22
Homalonotus Knightii - 24, 26
Hope Bowdler - 10, 22
Horderley - 10
,, Sandstone - 13, 24

Islands of Lower Llandovery Epoch - 14

Laurentian formation - 10
Lawley - 10, 11, 22
Lawrence Hill - 10
Leebotwood - 17
Leintwardine - 15, 27
Lewisian formation - 10
Lias - 18
Lichas Bucklandii - 26
Lilleshall Hill - 10
Lingulæ - 20, 24
Lingulella - 11
Linley Hall - 10, 12
Linley (Bridgnorth) - 16
,, Brook - 20
Llandeilo formation - 12
,, ,, rocks of - 21
Llandovery Series - 13
,, (May Hill) Conglomerate 14, 23
,, Limestone - 14
Long Lane - 13, 24
Longmynd Hills - 10, 14, 19, 21
Longville Common - 24
Ludford Lane - 26
Ludlow - 15, 25
,, (Upper & Lower) rocks 15, 20, 22, 24, 26, 27
Lydham Heath - 21
Lyell Sir C. - 17
Lyth Hill - 23

Marrington Dingle - 21
Marsh Brook - 13, 22
Marsh Farm - 20
Marston, Mr. - 26
Mary Knoll - 27
Maw, Mr. - 19
May-Hill Sandstone 11, 13, 20, 21, 23, 25
Meadow Town - 21
Millstone Grit - 16, 17
Mindtown - 10, 11
Minsterley - 20, 21
Mocktree Hill - 27
Modiolopsis lævis - 24
Mountain Limestone - 16, 28
Murchison, Sir R. - 10, 11, 13, 27
Mytton Dingle - 20

Nautilus Holtianus - 25
Norbury - 14, 21
Norton Camp - 15, 16, 24

Ogygia Caractaci - 21
Onchus - 26
Onibury - 24
Onny Shales - 13
,, Section - 23
Orodus ramosus - 28
Oswestry - 17

Pebidian formation - 10
Pedwardine - 11, 14, 25
Pennerley - 20
Pentamerus oblongus - 14, 22
Perkin's Beach Mine - 20
Permian Series - 17
Petraia sub-duplicata - 14
Phacops longicaudatus - 23, 27
Plaish - 22
Platyschisma - 24, 26
Plowden Station - 10, 11, 19. 23
Pontesbury - 10, 20
Pontesford Hill - 20
Proetus Stokesii - 26
Pre-Cambrian Series - 10
,, rocks of - 22, 24, 25
Primrose Hill - 10
Pteraspis - 16
,, *Ludensis* - 26
Pterichthys - 28
Pterygotus problematicus - 26

Ragleth - 10
Radnor Wood - 25
Rhynchosaurus - 18, 21
Richard's Castle - 27
Ritton Castle - 12, 20
Ripple Marks - 18, 21
Rock Hill - 25
,, of Woolbury - 25
Roman Gravels Mine - 21
Rorrington - 21
Ruabon - 17

St. David's - 10
Sandstone, Old Red, Series - 16
,, ,, Rocks of - 22, 28
,, New Red, Series - 17
Sharpstones Hill - 11, 23
Sheaves Farm - 22
Shelve - 12
Shineton - 11, 19
,, Shales - 10, 13, 21, 22, 25
Shrewsbury - 10
Silurian (Lower) Series - 11
,, (Upper) ,, - 14
Soudley - 13, 22
,, Sandstone - 22
Starfish - 27
Stiperstones - 10, 12, 21

Stokesay Castle - - - 15, 25
Strefford Bridge - - - - 23
Stretton, Church - - - - 10
,, Little - - - 11, 21

Tickwood Beds - - - - 19
Transition Series - - - - 16
,, ,, rocks of - - 20, 25
Tremadoc Beds - - - 10, 19
Triassic Series - - - - 17
Trinucleus concentricus - - 22, 23
Trippleton - - - - - 27
Trochoceras giganteum - - - 25

Wartle Knoll - - - 10, 24

Wellington - - - - - 10, 17
Wenlock Edge - - - - 15, 22
,, Limestone - 15, 19, 22, 24, 27
,, Shales - - 15, 19, 21, 23, 27
Weo Edge - - - - - 15, 25
White Grit Mine - - - 12, 20
Whittingslow - - - - - 13
Whittree Quarry - - - - - 21
Wigmore - - - - - - 15
Willey - - - - - - 16
Woolston - - - - - - 13
Worthen - - - - - 12, 15
Wrekin - - - - - 10, 17
Wrexham - - - - - - 17
Wyre Forest - - - - - 17

INDEX TO PARTS III. AND IV.

Where, in consequence of a later nomenclature or any other reason, the name of any fossil has been changed from that given in the Plate itself, the word "Read" has been prefixed.

The name at the foot of each Plate indicates, except in a few instances, which are noted, the earliest formation in which the fossils delineated above it are found; where these have a different horizon or wider range, the fact is stated at the end of the corresponding description.

NOTE.—The Roman numerals refer to the "Description of Plates."

Acervularia ... 33, vii.
Acidaspis ... 39, iii, x.
Acroculia ... xiv.
Actinocrinus ... 34.
Æglina ... 40, i, ii.
Agnostus ... 40, i, ii.
Alveolites ... 31, vii.
Ambonychia ... 48, xiv.
Ampyx ... 39, ii, iii.
Anodontopsis ... xviii.
Apiocystites ... 35, ix.
Arachnophyllum ... vii.
Arenicola ... 36, i.
Asaphus ... 39, i, ii, iii.
Ascoceras ... 52, xix.
Athyris ... 44.
Atrypa ... 44, vi, vii, xi, xii, xxi.
Auchenaspis ... 54, xx.
Aulopora ... 32.
Avicula ... 47, xviii.

Bellerophon ... 50, i, ii, v, vii, xiv, xix.
Beyrichia ... 36, iii, x.
Bryograptus ... xxii.

Callograptus ... 31, xviii.
Calymene ... 38, i, ii, iii, x.
Cardiola ... 48, xiv, xviii.
Cephalaspis ... 54, xx, xxii.
Ceratiocaris ... 37, xvii.
Ceriopora ... xi.
Cheirurus ... 40, ii, vi.
Chœtetes ... 32, 42.
Chonetes ... 45, xii, xviii.
Cnemidium ... vii.
Cœnites ... 31, vii.
Conocardium ... 48.
Conocoryphe ... 38, i.
Conophrys ... i.
Conularia ... 51, vii, xxi.
Cophinus ... xvi.
Cornulites ... 35, v, x.
Crania ... 46, xiii.
Crotalocrinus ... ix.
Ctenodonta ... 48, xviii, xxii.
Cucullella ... 48, xviii.
Cyathaspis ... 54, xx.
Cyathrocrinus ... 34, ix, xx.
Cyathophyllum ... 33, vii, viii.
Cybele ... 40, iii.
Cyclonema ... xviii.
Cyphaspis ... 39.
Cypricardia ... 49.
Cyrtia ... 44.
Cyrtoceras ... 52, ii, xv, xvi, xix.
Cyrtograptus ... xviii.
Cyrtolites ... 50, xviii.
Cystiphyllum ... 33, viii.

Dayia ... xii, xxi.
Diastopora ... xi.
Dictyonema ... 31, i, ii.
Didymaspis ... 54.
Didymograptus ... 31, i, ii.
Dinobolus ... xiii.
Diplograptus ... 31, ii, iii.
Discina ... 46, iv, xiii, xviii.
Discopora ... xi.

Ecculiomphalus ... 50, xviii.
Echinoencrinus ... 35, ix.
Eichwaldia ... 45, xii.
Encrinurus ... 40, vi, x.
Escharina ... xi.
Eucalyptocrinus ... 35, ix.
Euomphalus ... 50, ii, vii, xiv, xviii, xix.
Eurypterus ... 41, xvii.

Favosites ... 31, viii.
Fenestella ... 42, iii, xi.

Glassia ... xiii, xviii, xxi.
Glauconome ... 42, xi.
Glyptocrinus ... x.
Gomphoceras ... 52, xvi, xix.
Goniatites ... xv, xx.
Goniophora ... 49.
Grammysia ... 49, xiv, xviii.

Halysites ... 32, viii.
Heliolites ... 33, viii.
Hemiaspis ... 41, xvii, xxii.

Hemicyclaspis ... . xx.
Heteropora ... . xi.
Holopea ... ... 50, v.
Holopella ... .. 49, vii, xiv.
Holoptychius . . . . 53, xx.
Homalonotus ... ... 38, iii. x, xvii.
Hymenocaris ... ... 37.

Ichthyocrinus ... ... 34, ix.
Illœnus ... ... 40, ii, iii, v, x.
Ischadites .. .. 30, xvii.

Labechia ... ... 30, ix.
Leperditia .. .. . 36, xxii.
Leptœna .. 45, iv, vi, xii, xiii, xxi, xxii.
Lichapyge ... . i.
Lichas .. ..39, iii, x.
Lingula ... .. 46, ii, iv, xiii, xviii.
Lingulella ... . 46, i.
Lithostrotion ... ... 33, xx.
Lithodomus ... ... xxii.
Lituites .. .. 53, xv, xix.
Loxomma ... ... 54, xxi.
Loxonema ... ... 49, xviii.

Maclurea ... . 50.
Macrocystella .. .. i.
Marsupiocrinites ... ... ix.
Merista .. .. 44, xxi.
Meristella ... ... xiii.
Meristina ... ... xiii.
Modiolopsis ... ... 48, iv, xiv, xviii.
Monograptus ... ... 31, xi, xviii.
Monticulipora ... .. 42, iii, vii.
Murchisonia ... ... 50, v, xiv, xviii.
Mytilus ... . 48, xiv.

Natica .. .. xviii.
Nautilus ... . 53, xv, xix.
Nucleospira .. .. xii.
Nucula ... ... 48.

Obolella ... ... 46, i.
Obolus .. .. 46.
Ogygia ... . 40, i, ii.
Olenus .. .. 38, i.
Omphyma ... ... 33, viii, ix.
Onchus .. .. xx.
Ophidioceras ... . 53, xvi.
Orbiculoidea ... . xiii.
Orodus ... . xx.
Orthis .. 45, iv, vi, vii, xii, xviii, xxii.
Orthoceras 52, ii, xv, xvi, xix, xxi, xxii.
Orthonota ... ... 48, v, xviii, xxii.

Pachytheca ... . xvi, xxii.
Palæaster .. .. 34, xvii.
Palæocoma ... ... xvii.
Palæocyclus ... . 33, ix.
Palasterina .. .. 34, xvii.
Parka decipiens ... ... 41, xx.
Pentamerus .. .. 45, vi, xi.
Periechocrinus ... . 34, ix.
Petraia ... ...32, v, ix.
Phacops ... ... 38, iii, vi, x.
Phillipsia ... ... 39, xx.
Phragmoceras ... ... 52, xv, xvi.
Phyllopora ... ... 42.

Physocaris ... ... xxii.
Placodus .. .. 53.
Platycrinus .. .. .. 34, ix.
Platyschisma .. ..50, xviii.
Plectrodus .. .. xx.
Pleurorhynchus .. .. 48, xiv.
Pleurotomaria .. ... 50, v, xviii.
Polypora . . .. 42, xi.
Primitia ... ... 36.
Productus ... ... 46, xx.
Proetus ... ... 39, x.
Protaster ... . 34, xvii.
Prunocystites .. ... . 35, ix.
Pseudocrinites .. . . ix.
Pteraspis .. . . 54, xx.
Pterichthys ... . 54, xxii.
Pterinea ... . 48, xiv, xviii.
Pterygotus ... ... 41, xvii, xxii.
Ptilograptus ... . 31, xviii.
Ptychophyllum ... . viii.
Ptylodictya . ... . 42, xi.

Raphistoma . . .. vii.
Redonia ... ... ii, xviii.
Remopleurides . ... 38, iii.
Retepora .. .. 42, xi.
Retzia ... . 44, xi.
Rhynconella . 45, vi, x, xii, xxi, xxii.
Rhyncosaurus .. .. 54, xxi.

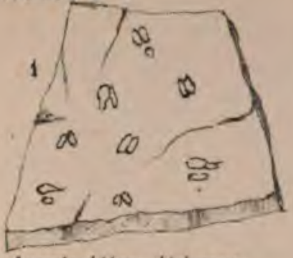
Sarcinula .. .. ix.
Scaphaspis ... ... 54, xx.
Scolithus .. .. 36, i.
Scyphaster .. .. xvii.
Serpulites . ... 36, x.
Siphonotreta .. .. 46, xiii.
Slimonia . . .. 41.
Sphœrexochus ... . 40, x.
Sphœrospongia ... . .. 30, iii.
Sphagodus ... . xx.
Spirifera ... . 44, vi, xiii, xx.
Spirorbis .. .. 35, x.
Spongarium ... . xvi.
Stenopora ... ... 42, viii.
Strephodes ... . ix.
Streptorhynchus ... . xii.
Stricklandinia ... .. 45, vi, xxi.
Stromatopora ... . 30, vii.
Strombodes ... . 33.
Strophomena ... 45, iv, vi, xiii, xviii, xxi.
Stylonurus ... . 41, xvii.
Syringopora . ... 32, vii, ix.

Taxocrinus . . ... . 34, ix.
Tentaculites ... .. 51, iii, x, xvii.
Terebratula ... ... 44, xx.
Theca ... ... 51, i, ii, v, ix.
Thelodus ... ... xx.
Trachyderma .. .. 36, xvii,
Trematis .. .. 46, iv.
Trinucleus ... .. 39, i, ii, iii.
Triplesia .. .. 45, xxi.
Trochoceras .. .. 53, xv, xix.
Trochus ... .50, xviii.
Turbo ... ... 50.

Waldheimia .. .. 44, xxi.
Whitfieldia .. .. 44, xiii, xxi.

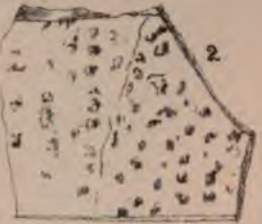
PLATE I

1



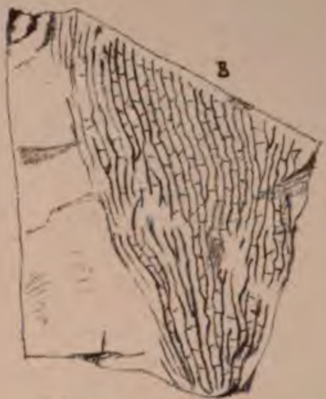
Arenicolites didymus
Ashes valley Little Stretton

2



Arenicolites sparsus
Ashes valley

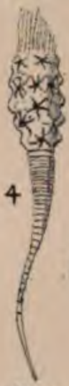
3



Dictyonema sociale
Pedwardine.

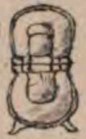
LONGMYND

4



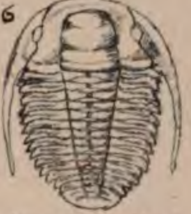
Macrocystella Mariæ
Shineton

5



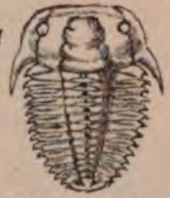
Agnostus dux
Shineton

6



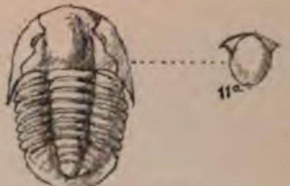
Olenus triarthrus
Shineton

7



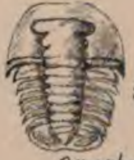
Olenus Salteri
Shineton

11 11ª



Asaphus Croftii
Shineton.

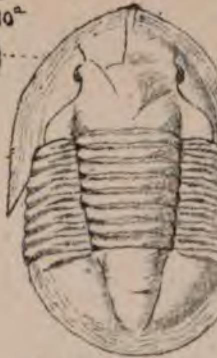
8



Conophrys salopiensis
Shineton

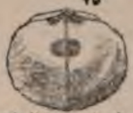
10ª

10



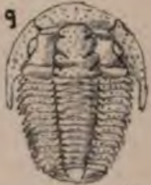
Asaphus Homfrayi
Shineton

13



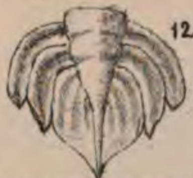
Obolella Sabrinæ
Shineton

9



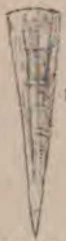
Conocoryphe monile
Shineton

12



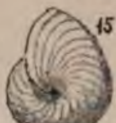
Lichapyge cuspidata
Shineton

16



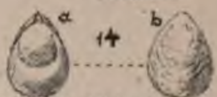
Theca lineata
Shineton

15



Bellerophon Shinetonensis
Shineton

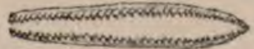
14



Lingulella Nicholsoni
Shineton

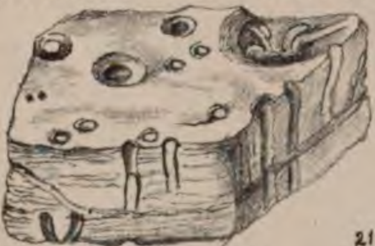
TREMADOC

17



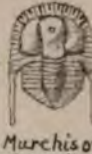
Didymograpsus geminus
White grit mine

18



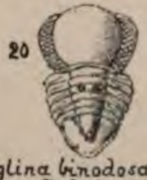
Scolithus linearis
Stiper Stones

19



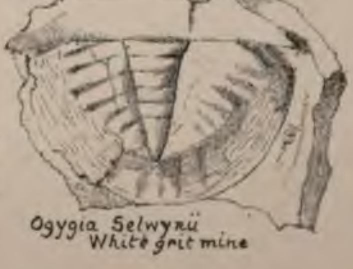
Trinucleus Murchisoni
Cefn Gwynlle

20



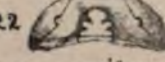
Æglina binodosa
Cefn Gwynlle

21



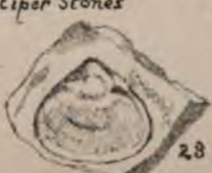
Ogygia Selwynii
White grit mine

22



Calymene parvifrons
Lord's hill

23



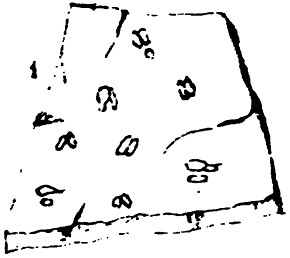
Obolella plumbea
White grit mine

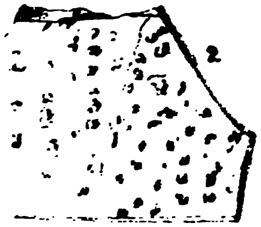
ARENIG

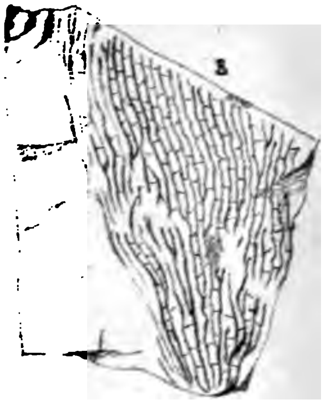
La Touche

MINTT & HARRTON, [illegible]

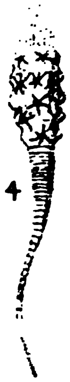
PLATE I

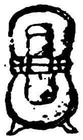
1

Arenicolites didymus
Ashes valley Little Stretton

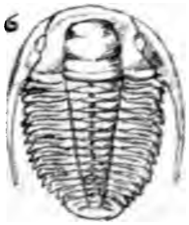
2

Arenicolites sparsus
Ashes valley

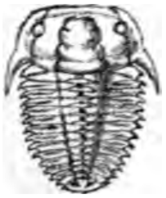
3

Dictyonema sociale
Pedwardine.

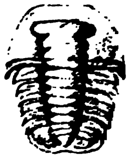
LONGMYND

4

Macrocystella Mariæ
Shineton

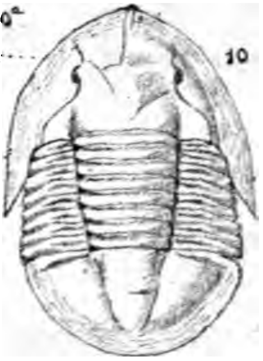
5

Agnostus dux
Shineton

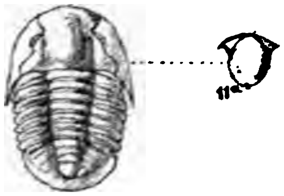
6

Olenus triarthrus
Shineton

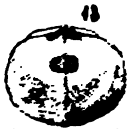
7

Olenus Salteri
Shineton

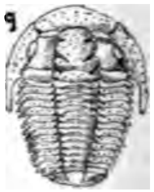
8

Conophrys salopiensis
Shineton

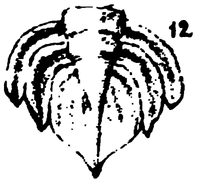
10ª

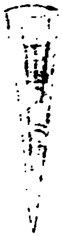
10

Asaphus Homfrayi
Shineton

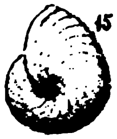
11 11ª

Asaphus Croftii
Shineton.

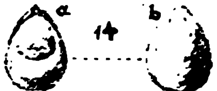
13

Obolella Sabrinæ
Shineton

9

Conocoryphe monile.
Shineton

12

Lichapyge cuspidata
Shineton

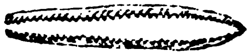
16

Theca lineata
Shineton

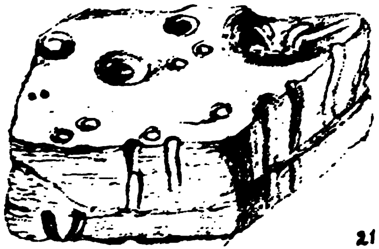
15

Bellerophon Shinetonensis
Shineton

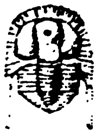
14


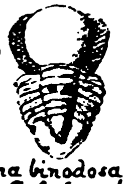
Lingulella Nicholsoni
Shineton

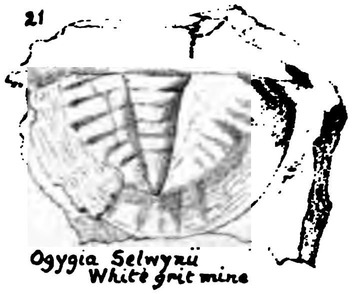
TREMADOC

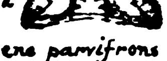
17

Didymograpsus geminus
White grit mine

18

Scolithus linearis
Stiper Stones

19

Trinucleus Murchisoni
Cefn Gwynlle

20

Æglina binodosa
Cefn Gwynlle

21

Ogygia Selwynii
White grit mine

22

Calymene parvifrons
Lond's hill

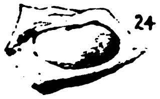
23

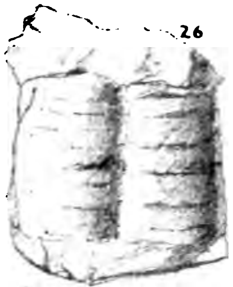
Obolella plumbea
White grit mine

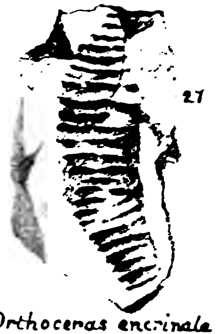
ARENIG

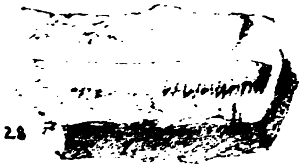
ADNITT & NAUNTON, SALOP

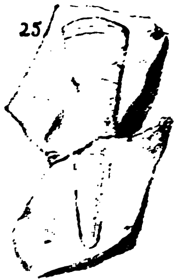
PLATE II


24
Cuculella anglica
White grit mine

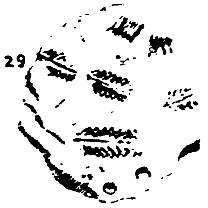

26
Orthoceras Avelinii
Cefn Gwynlle

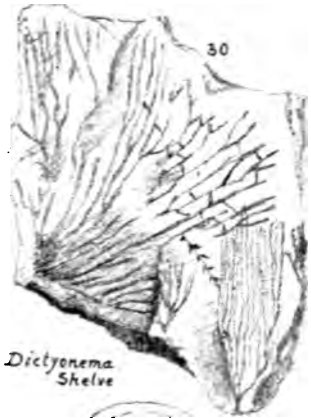

27
Orthoceras encrinale
Cefn Gwynlle


28
Graptolithus ?
Shelve

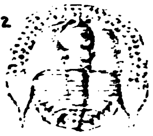

25
Theca simplex
White grit mine

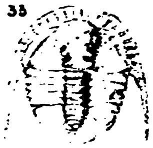
ARENIG

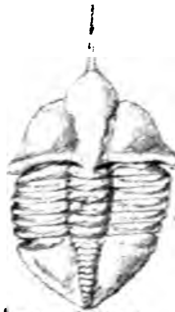

29
Diplograpsus foliaceus
Meadow-town

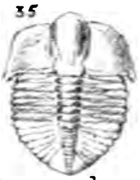

30
Dictyonema
Shelve

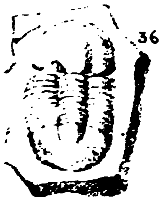
31
Agnostus Maccoyi
Builth

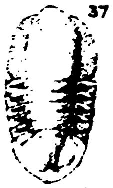

32
Trinucleus Lloydii
(Middleton, Chirbury)


33
Trinucleus Gibbsii
Linley

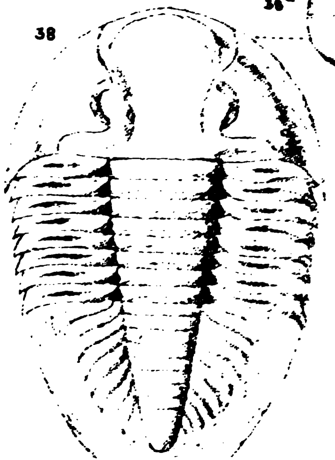

34
Ampyx Salteri
Linley

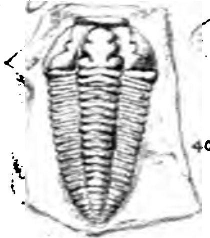

35
Ampyx nudus
Builth


36
Illænus perovalis
N.E. end of Corndon Hill

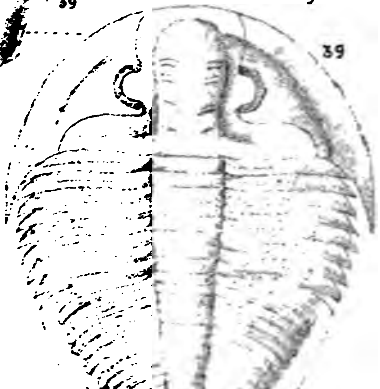

37
Æglina mirabilis
Linley

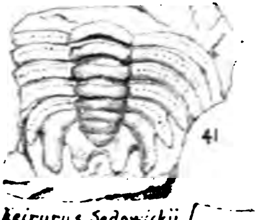
38a

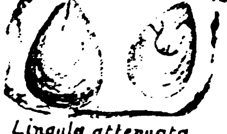

38
Asaphus tyrannus
Meadowtown


40
Calymene cambrensis
Linley

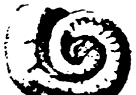
39a

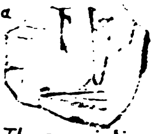

39
Ogygia Buchii
Meadowtown

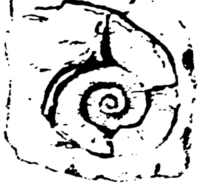

41
Cheirurus Sedgwickii
Linley

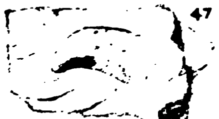

42
Lingula attenuata
Shelve

43
Lingula granulata
Shelve


44
Euomphalus corndensis
Leigh Hall, Corndon.


45
Theca socialis
Linley

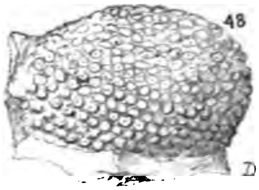

46
Bellerophon perturbatus
Shelve


47
Cyrtoceras
?*multicameratum*
Linley

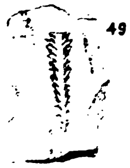
LLANDEILO

La Touche

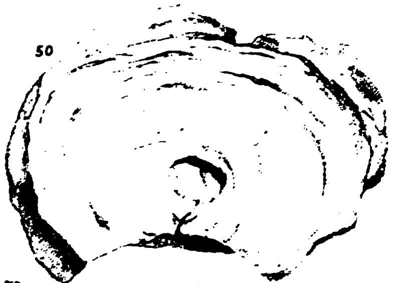
PLATE III


48

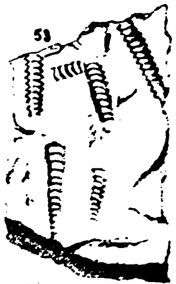
Sphærospongia hospitalis
Cheney Longville


49

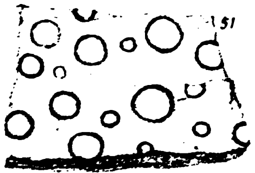
Diplograpsus pristis
Soudley


50

Monticulipora favulosa
Gretton


53

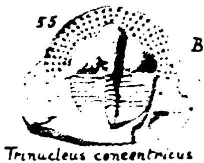
Tentaculites anglicus
Marsh brook


51

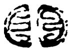
Glyptocrinus
Marsh brook

52

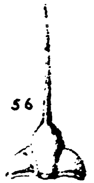
Cyclocystoides Caractaci
Cheney Longville


55

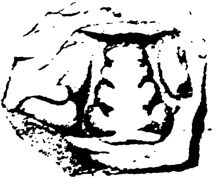
Trinucleus concentricus
Onny section

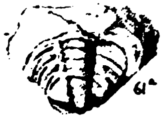

54

Beyrichia complicata
Horderley

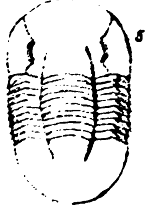

56

Ampyx pennatus
Onny section

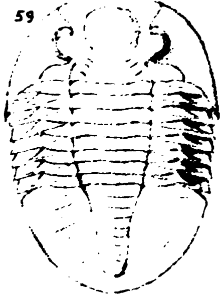

61


61a

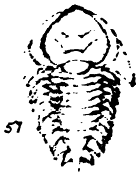
Calymene Caractaci
Marsh brook


58

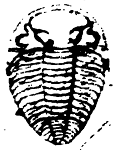
Illænus Davisii

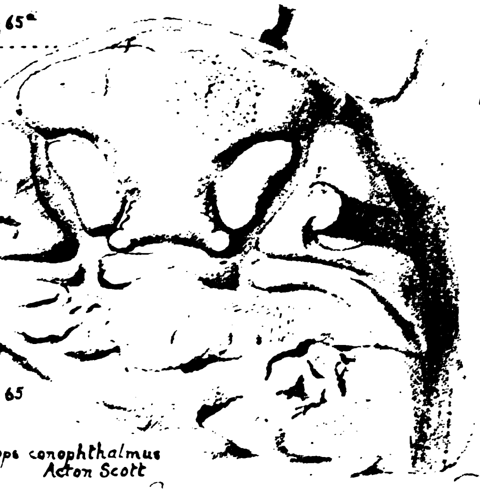

59

Asaphus Powysii
Horderley

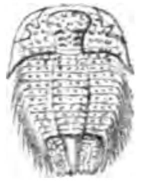

57

Remopleurides sp:
Onny section

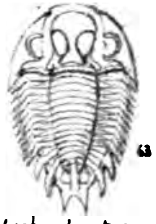

65a


65

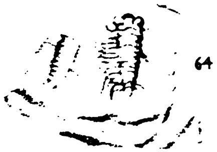
Phacops conophthalmus
Acton Scott


60

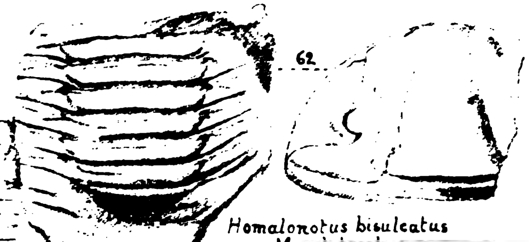
Cybele verrucosa
Soudley ?


63

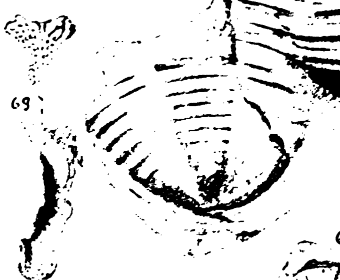
Lichas laxatus
Acton Scott


64

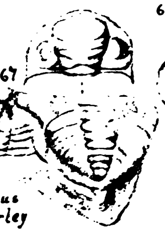
Acidaspis Caractaci
Gretton


62

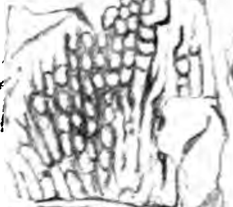
Homalonotus bisulcatus
Marsh brook


69

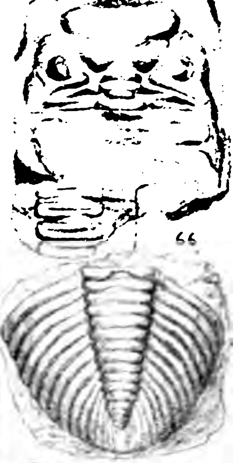
Bryozoa
Acton Scott


67

Phacops apiculatus
Horderley


68

Fenestella
Marsh brook


66

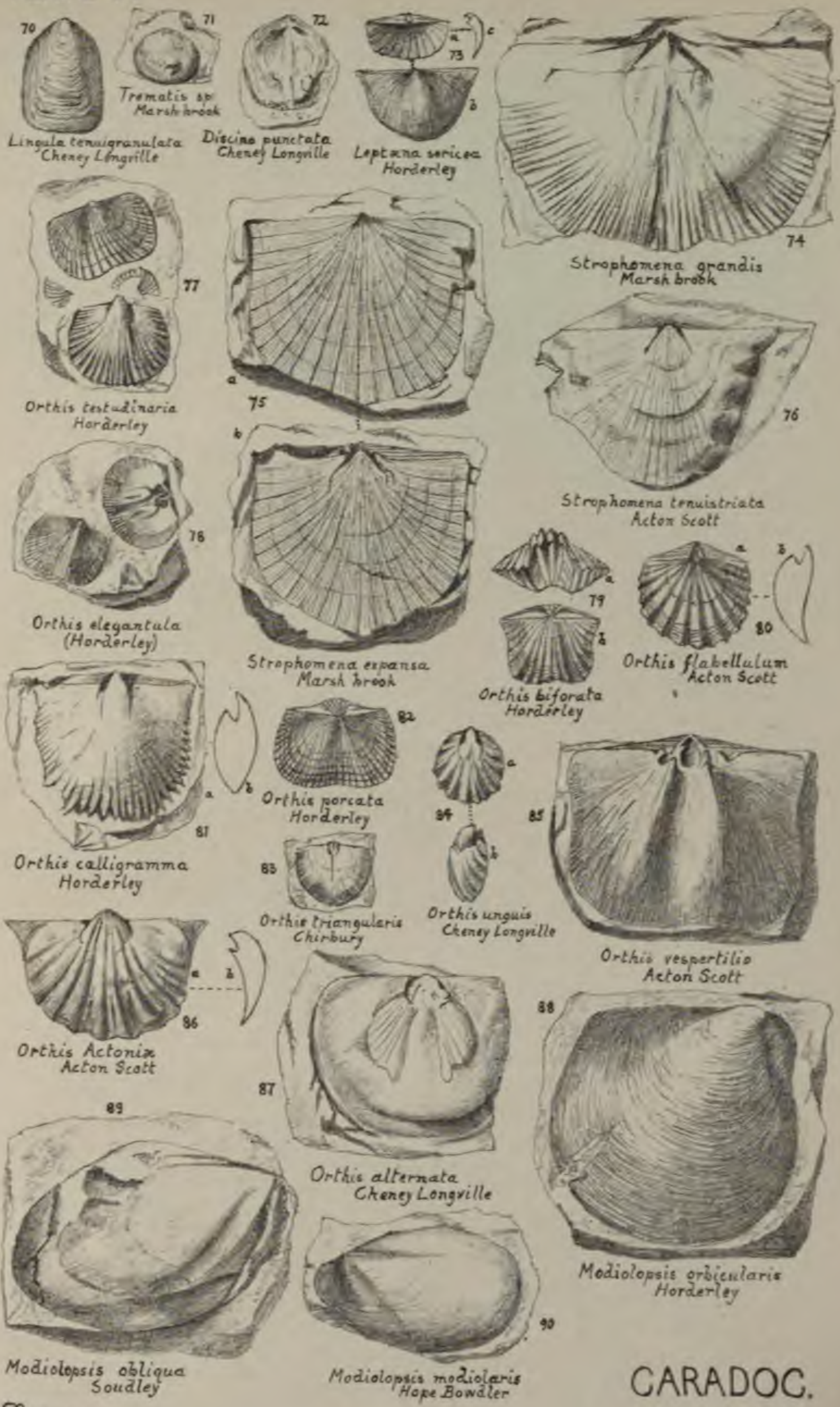
Phacops macroura
Acton Scott

CARADOC

La Touche

ABBITT & NAUNTON, SALOP

PLATE IV



Lingula tenuigranulata
Cheney Longville

Trematis sp
Marsh brook

Discina punctata
Cheney Longville

Leptæna sericea
Horderley

Strophomena grandis
Marsh brook

Orthis testudinaria
Horderley

Strophomena tenuistriata
Acton Scott

Orthis elegantula
(Horderley)

Strophomena expansa
Marsh brook

Orthis biforata
Horderley

Orthis flabellulum
Acton Scott

Orthis calligramma
Horderley

Orthis porcata
Horderley

Orthis triangularis
Chirbury

Orthis unguis
Cheney Longville

Orthis vespertilio
Acton Scott

Orthis Actoniæ
Acton Scott

Orthis alternata
Cheney Longville

Modiolopsis orbicularis
Horderley

Modiolopsis obliqua
Soudley

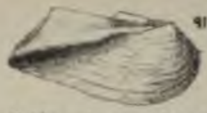
Modiolopsis modiolaris
Hope Bowdler

CARADOC.

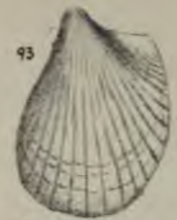
La Touche

[illegible]

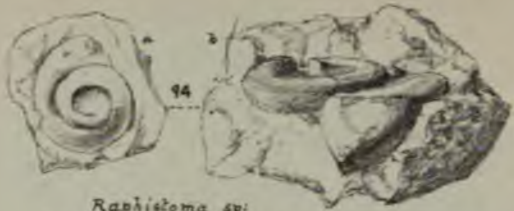
PLATE V


91

Orthonota postlineata
Marsh brook

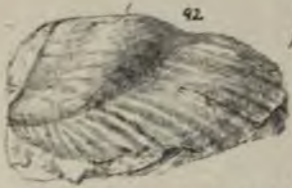

93

Ambonychia
Acton Scott

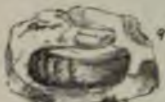


94

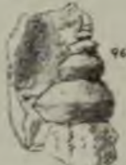
Raphistoma sp:
Lawley Onny


92

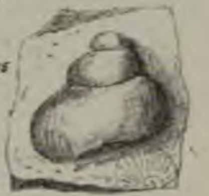
Orthonota semisulcata ?
Ticklerton brook


97

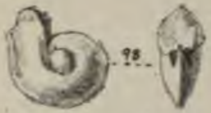
Pleurotomaria latifasciata
Marsh brook


96

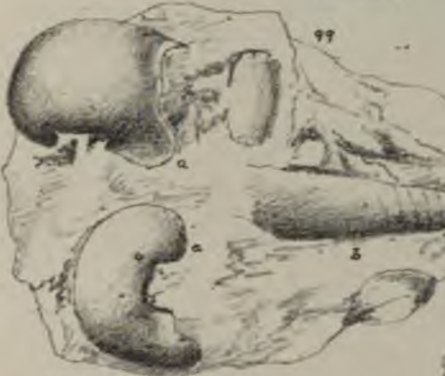
Murchisonia gyrogonia
Horderley


95

Holopea striatella
Horderley

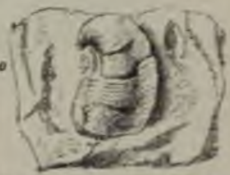

98

Bellerophon acutus
Horderley

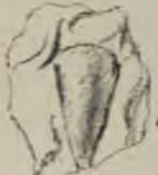


99

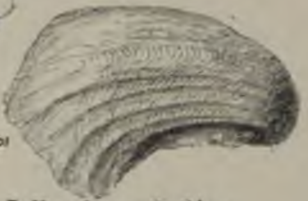
Bellerophon bilobatus
with *Orthoceras ?*
Marsh brook


100

Bellerophon nodosus
Marsh brook

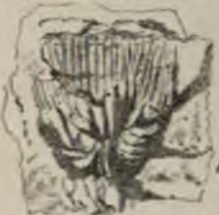

102

Theca reversa
Batch gutter

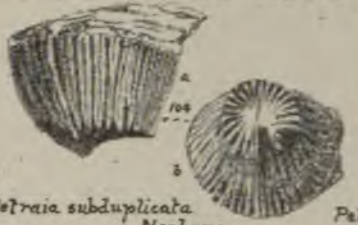

101

Bellerophon sulcatinus
Marsh brook

CARADOC

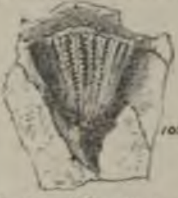

103

Petraia elongata
Norbury

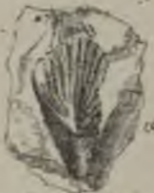


104

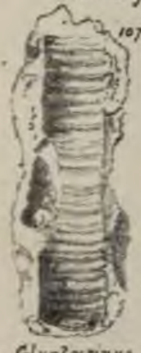
Petraia subduplicata
Norbury


105

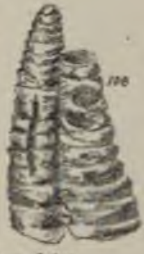
Petraia subduplicata
var. *crenulata*
Norbury


106

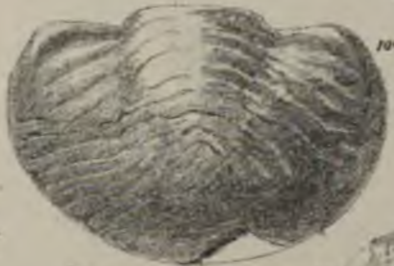
Petraia bina
Norbury


107

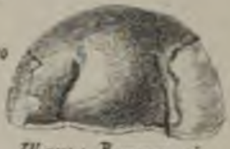
Glyptocrinus
Norbury


108

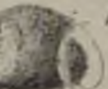
Cornulites serpularius
Bog mine Shelve


109

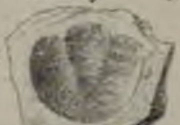
Illænus æmulus
Norbury


110

Illænus Bowmanni
Norbury


111

Illænus Barriensis
Purple shales Onny section

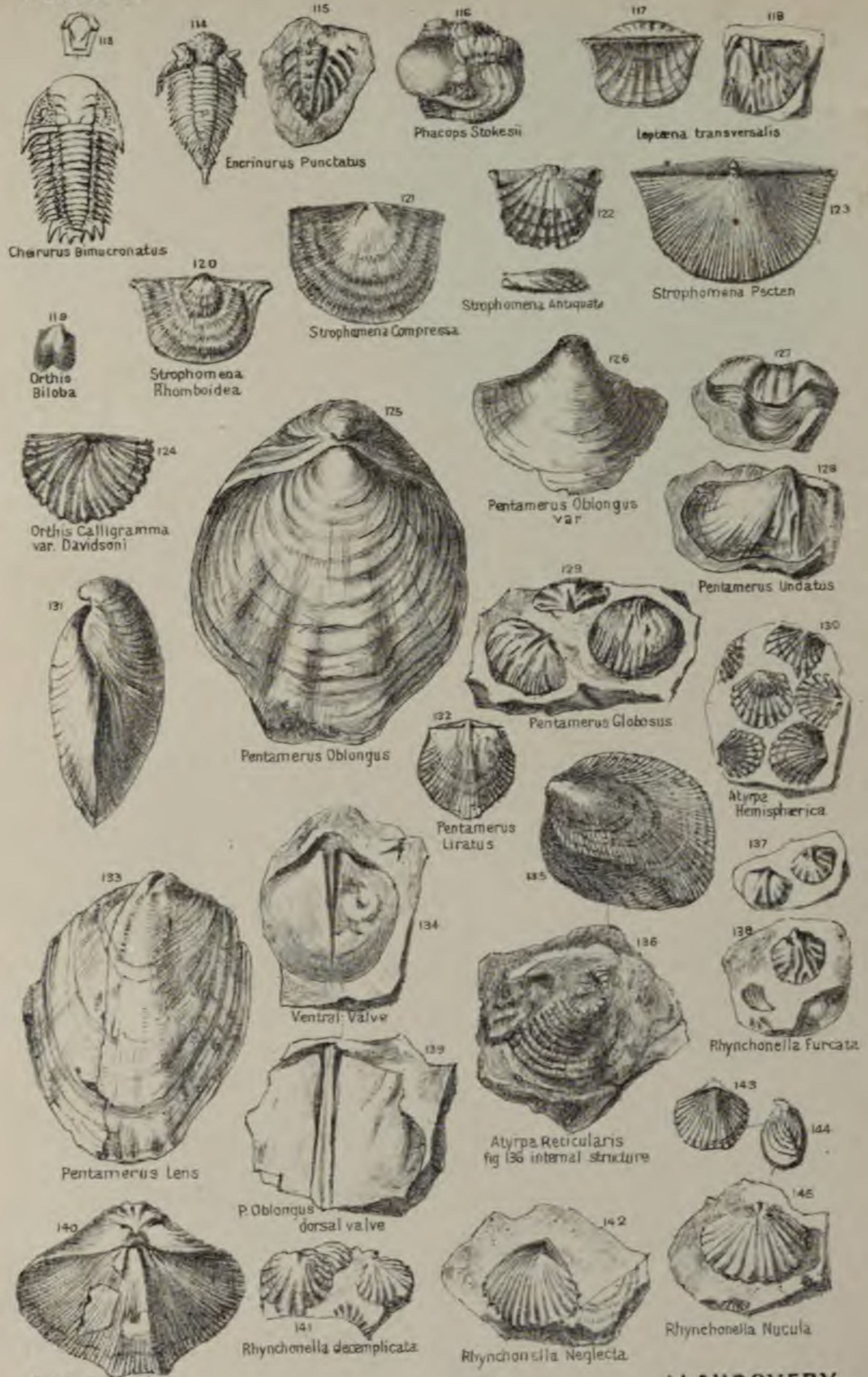

112

Illænus Thomsoni
Purple shales Onny section

LLANDOVERY

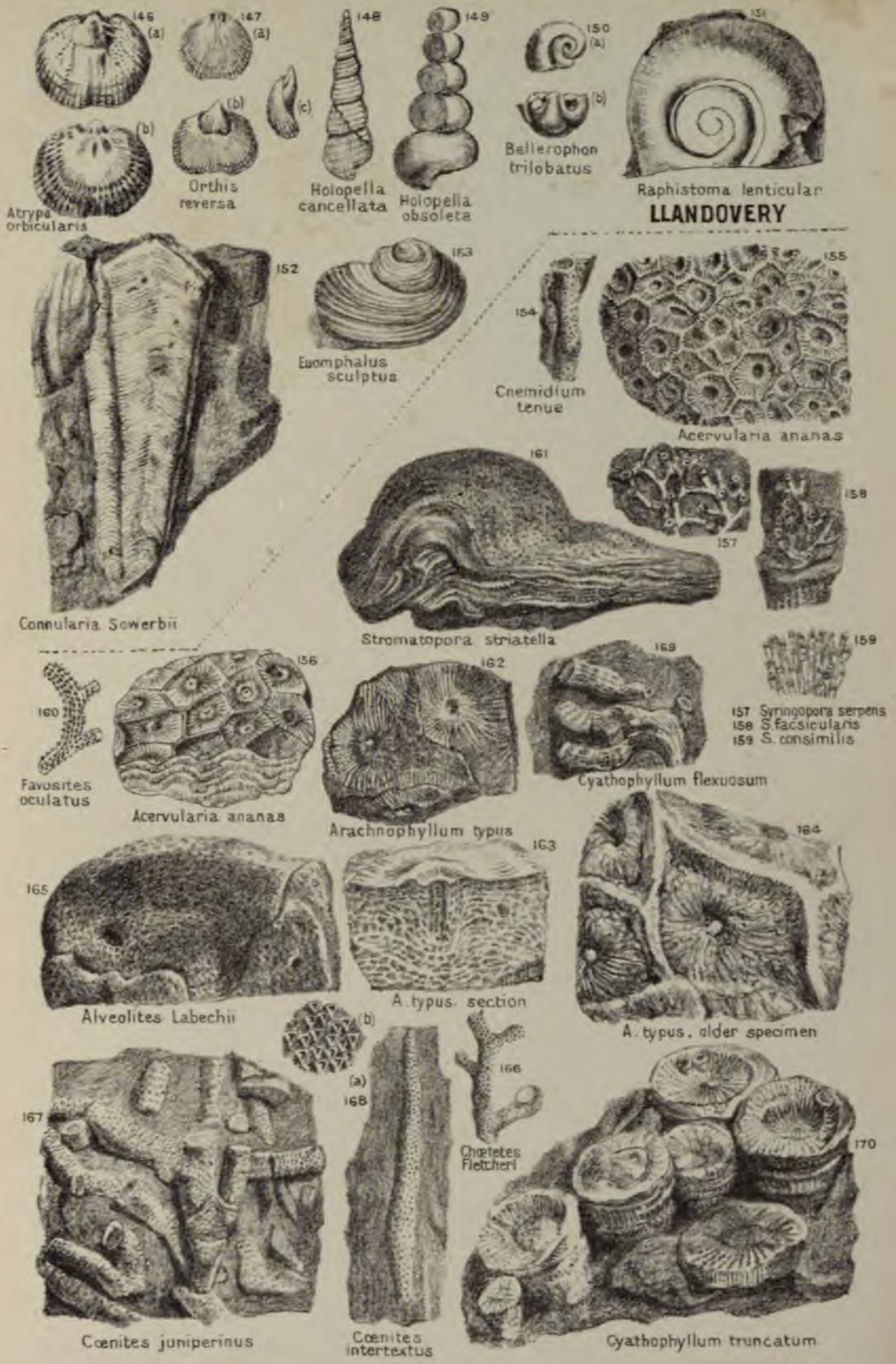
La Touche

PLATE VI



LLANDOVERY

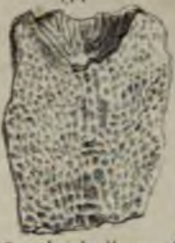
PLATE VII.



J.D.la T. del.

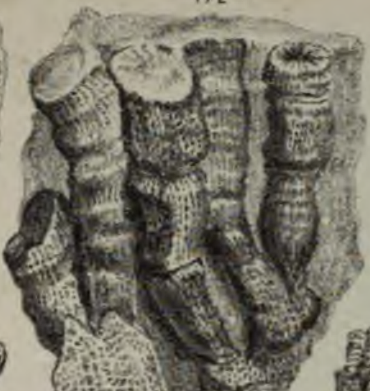
PLATE VIII

171



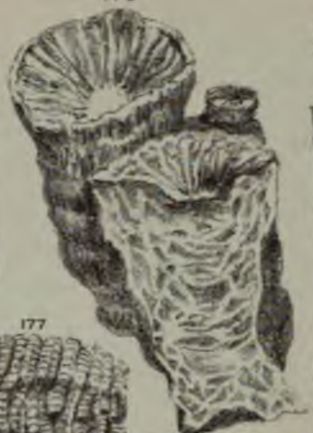
Cyathophyllum angustum

172



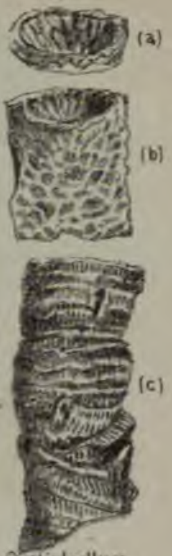
Cyathophyllum articulatum

173



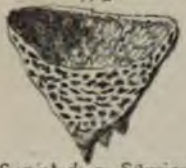
Omphyma Murchisoni

174



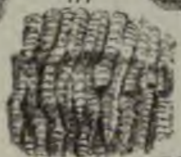
Cystiphyllum cylindricum

175

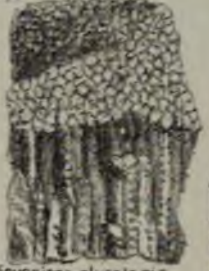


Cystiphyllum Siluriense

177

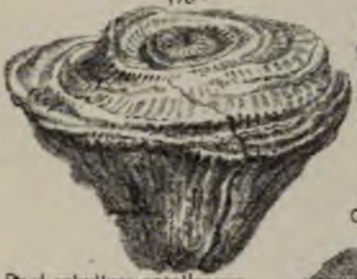


176



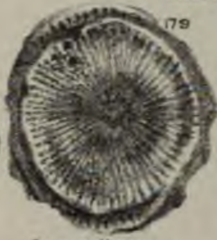
Favosites alveolaris
177 weathered specimen

178



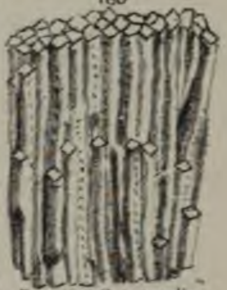
Ptychophyllum patellatum

179



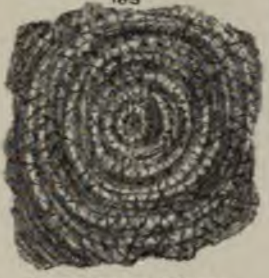
P. patellatum
Cup of young specimen

180



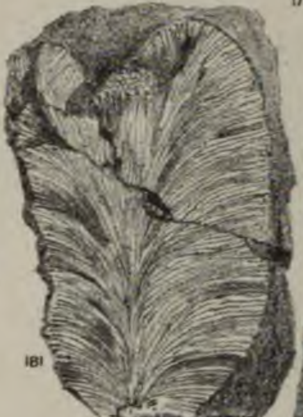
Favosites Gothlandica

185



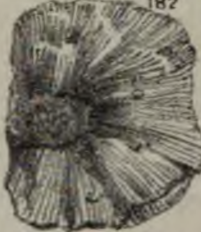
Favosites multipora

181



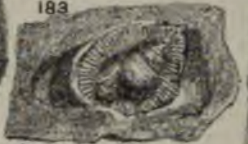
Stenopora fibrosa

182



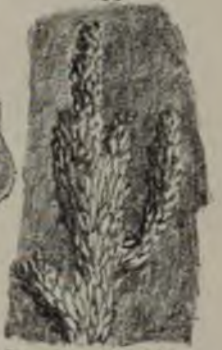
Stenopora fibrosa

183



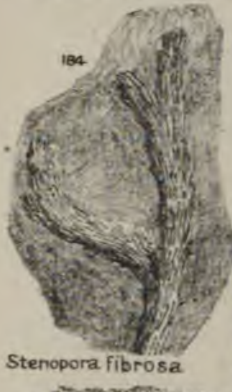
Stenopora fibrosa
var. incrustans

186



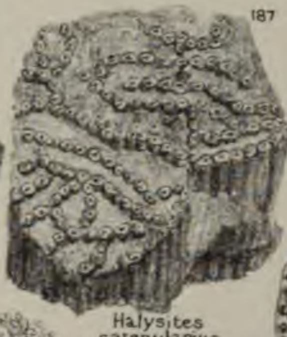
Favosites cristata

184



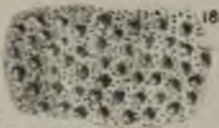
Stenopora fibrosa

187



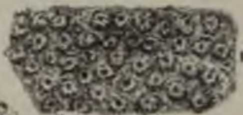
Halysites catenularius

188



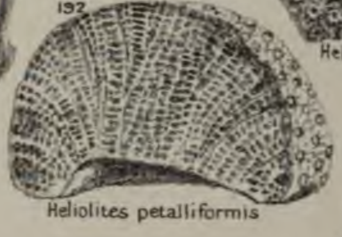
Heliolites interstinctus

189



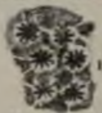
Heliolites tubulatus

192



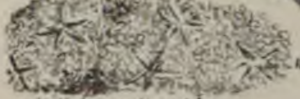
Heliolites petalliformis

190



H. tubulatus
magnified twice

191



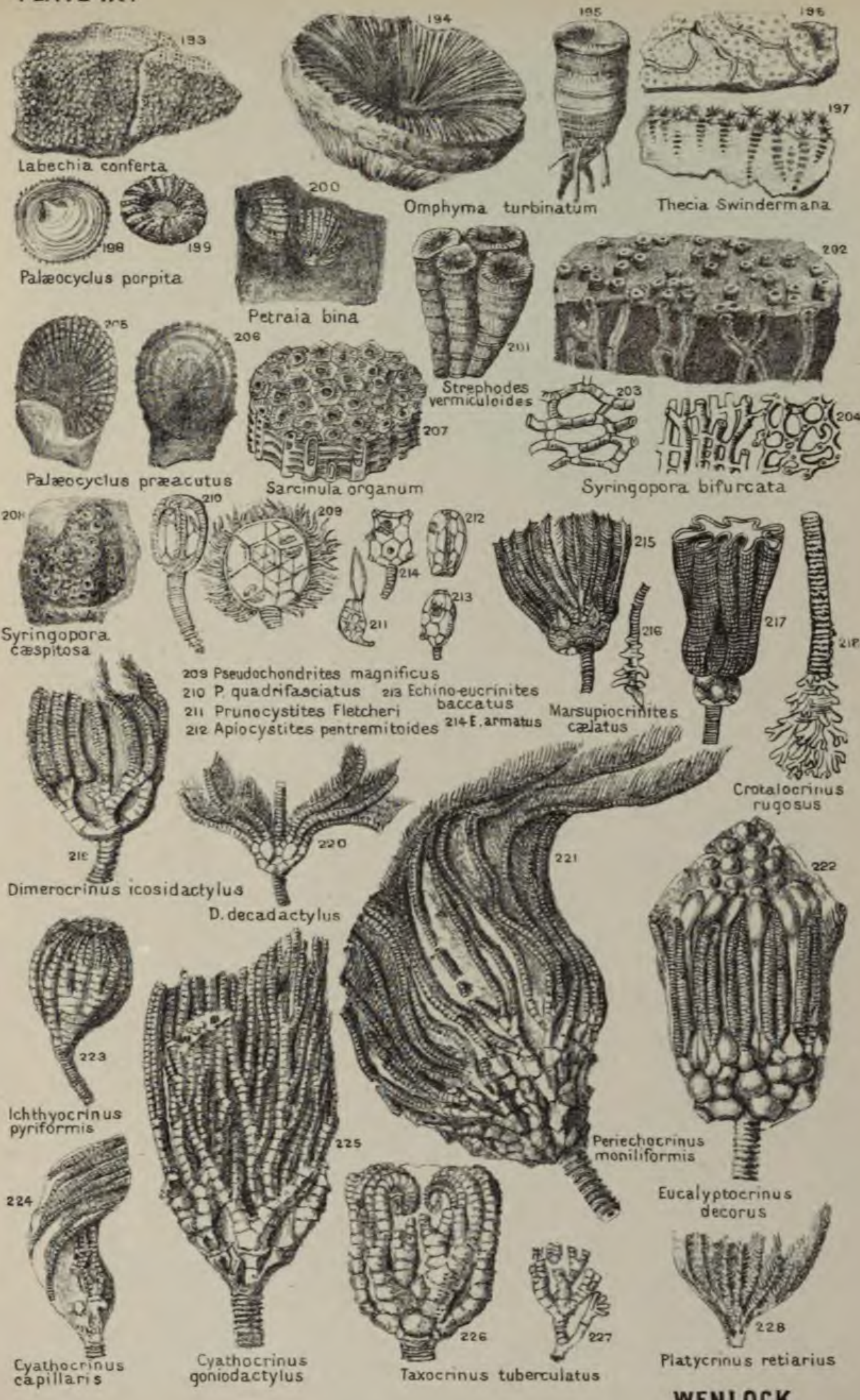
Heliolites discoideus

WENLOCK

[illegible]

J. D. La T. del.

PLATE IX.



Labechia conferta

Omphyma turbinatum

Thecia Swindermana

Palæocyclus porpita

Petraia bina

Strephodes vermiculoides

Palæocyclus præacutus

Sarcinula organum

Syringopora bifurcata

Syringopora cæspitosa

209 Pseudochondrites magnificus
210 P. quadrifasciatus
211 Prunocystites Fletcheri
212 Apiocystites pentremitoides
213 Echino-eucrinites baccatus
214 E. armatus

Marsupiocrinites cælatus

Crotalocrinus rugosus

Dimerocrinus icosidactylus

D. decadactylus

Periechocrinus moniliformis

Eucalyptocrinus decorus

Ichthyocrinus pyriformis

Cyathocrinus capillaris

Cyathocrinus goniodactylus

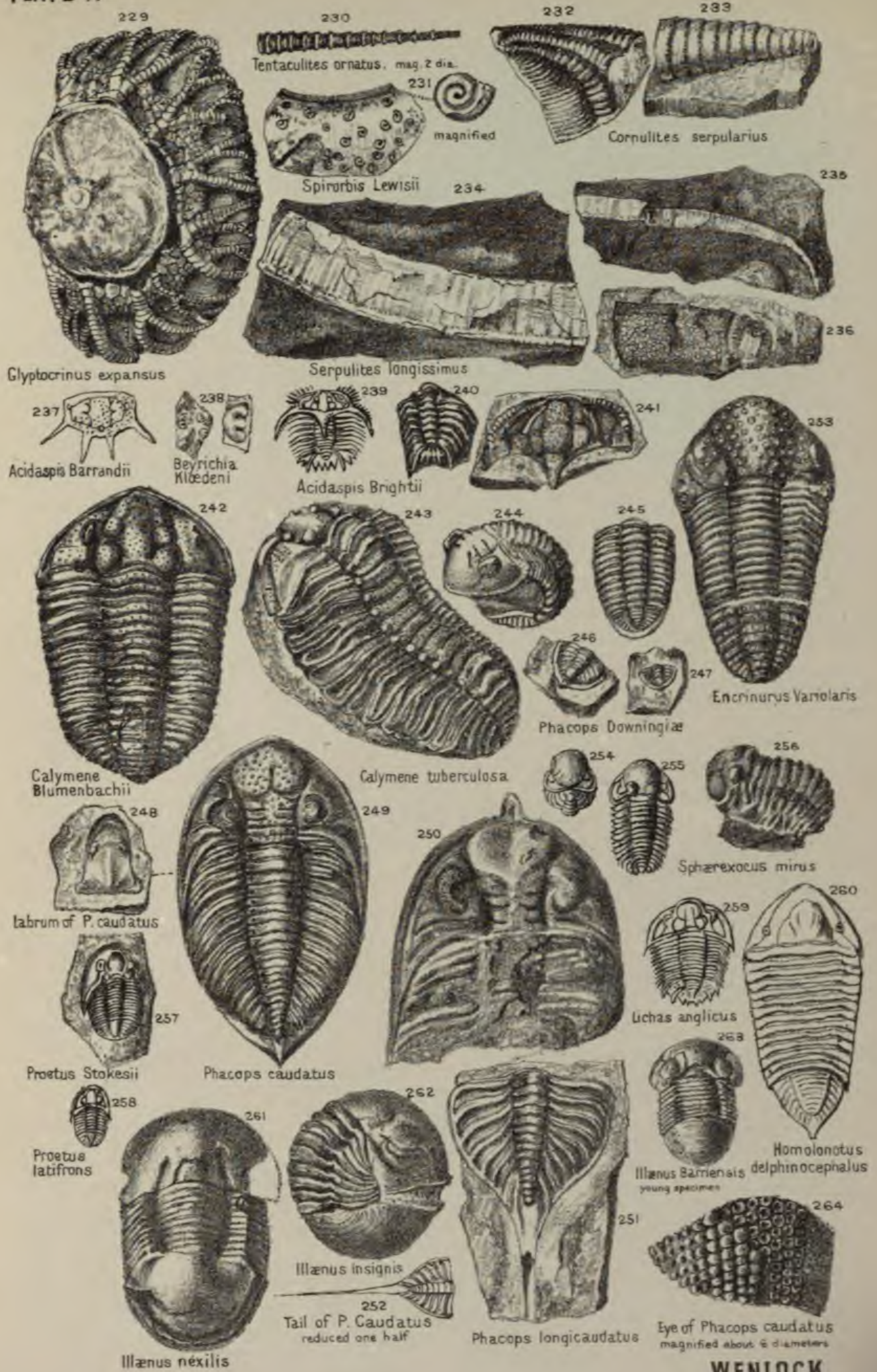
Taxocrinus tuberculatus

Platycrinus retiarius

WENLOCK

J.D. La T. del.

PLATE X



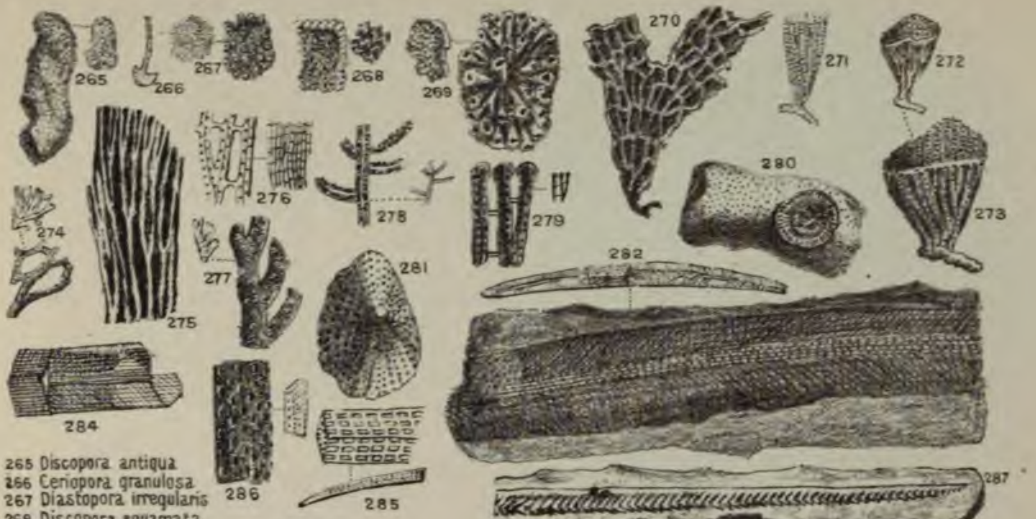
WENLOCK

J. D. la T. del.

ADNITT & NAUNTON, SALOP.

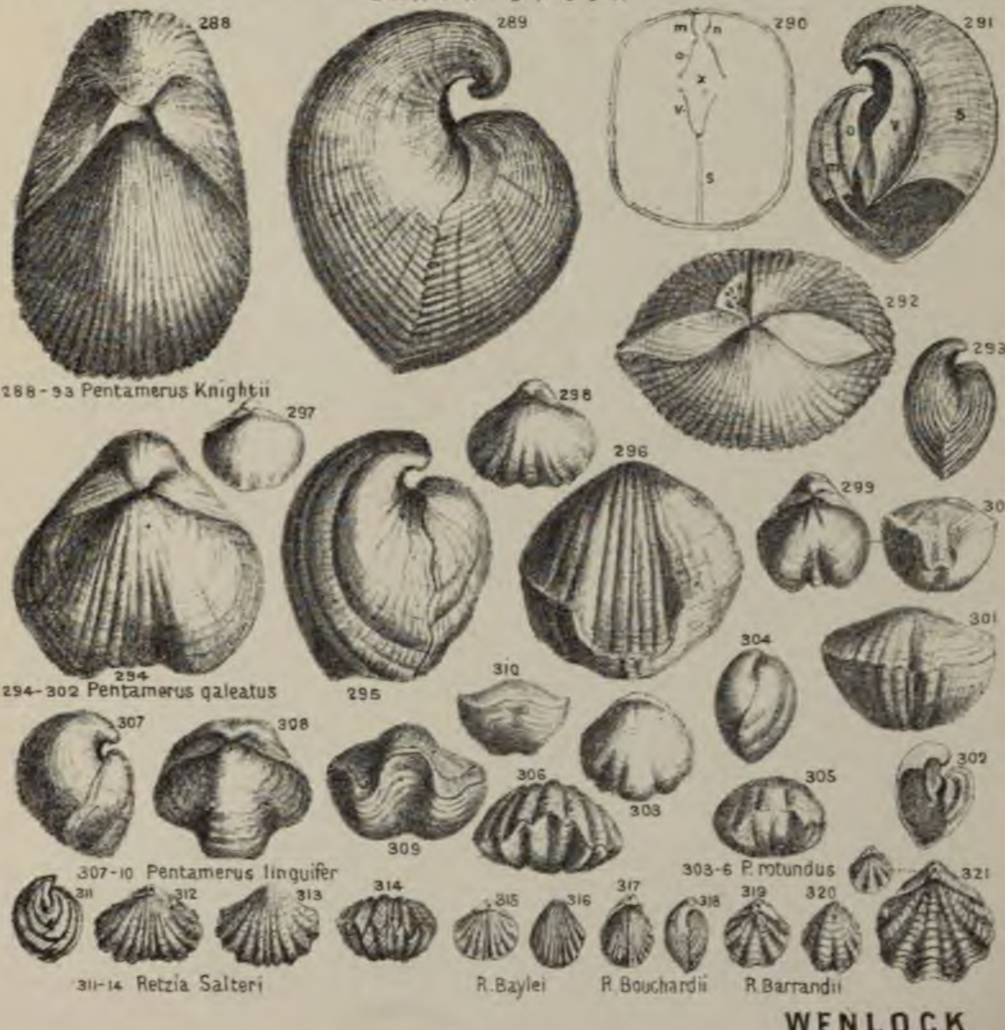
PLATE XI

BRYOZOA



265 Discopora antiqua
266 Ceriopora granulosa
267 Diastopora irregularis
268 Discopora squamata
269 Escharina angularis
270 Fenestella assimilis
271-3 F. Lonsdalii
274 F. reticulata
275 F. Milleri
276 F. subantiqua
277 Polypora crassa
278 Glauconome disticha
279 Fenestella antiqua
280 Heteropora crassa
281 Discopora disticha
282-5 Ptilodictya lanceolata
286 P. scapellum
287 Graptolithus priodon

BRACHIOPODA



288-93 Pentamerus Knightii

294-302 Pentamerus galeatus

307-10 Pentamerus linguifer

303-6 P. rotundus

311-14 Retzia Salteri

R. Baylei

R. Bouchardii

R. Barrandii

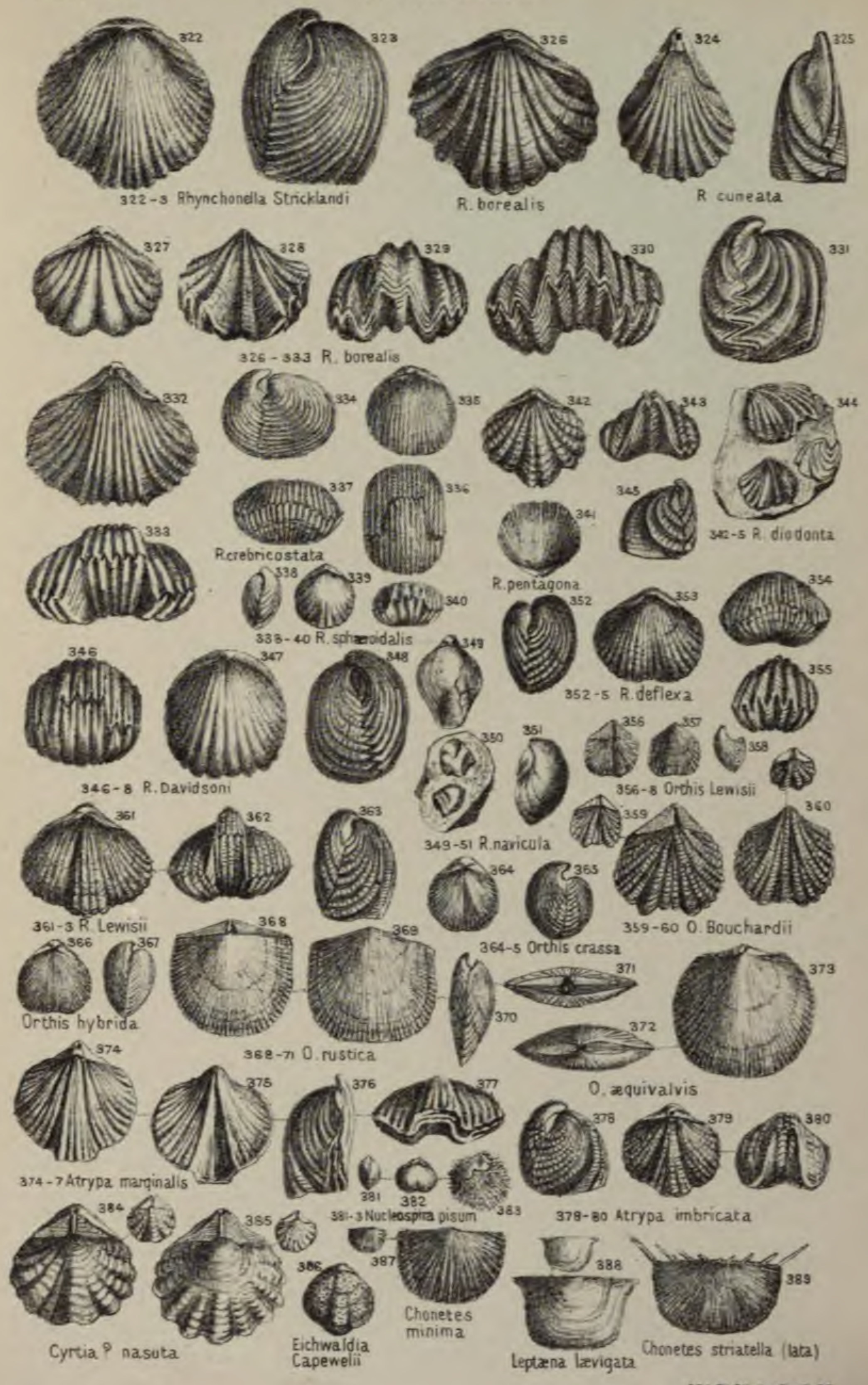
WENLOCK

[illegible]

J. D. la T. del.

PLATE XII

BRACHIOPODA



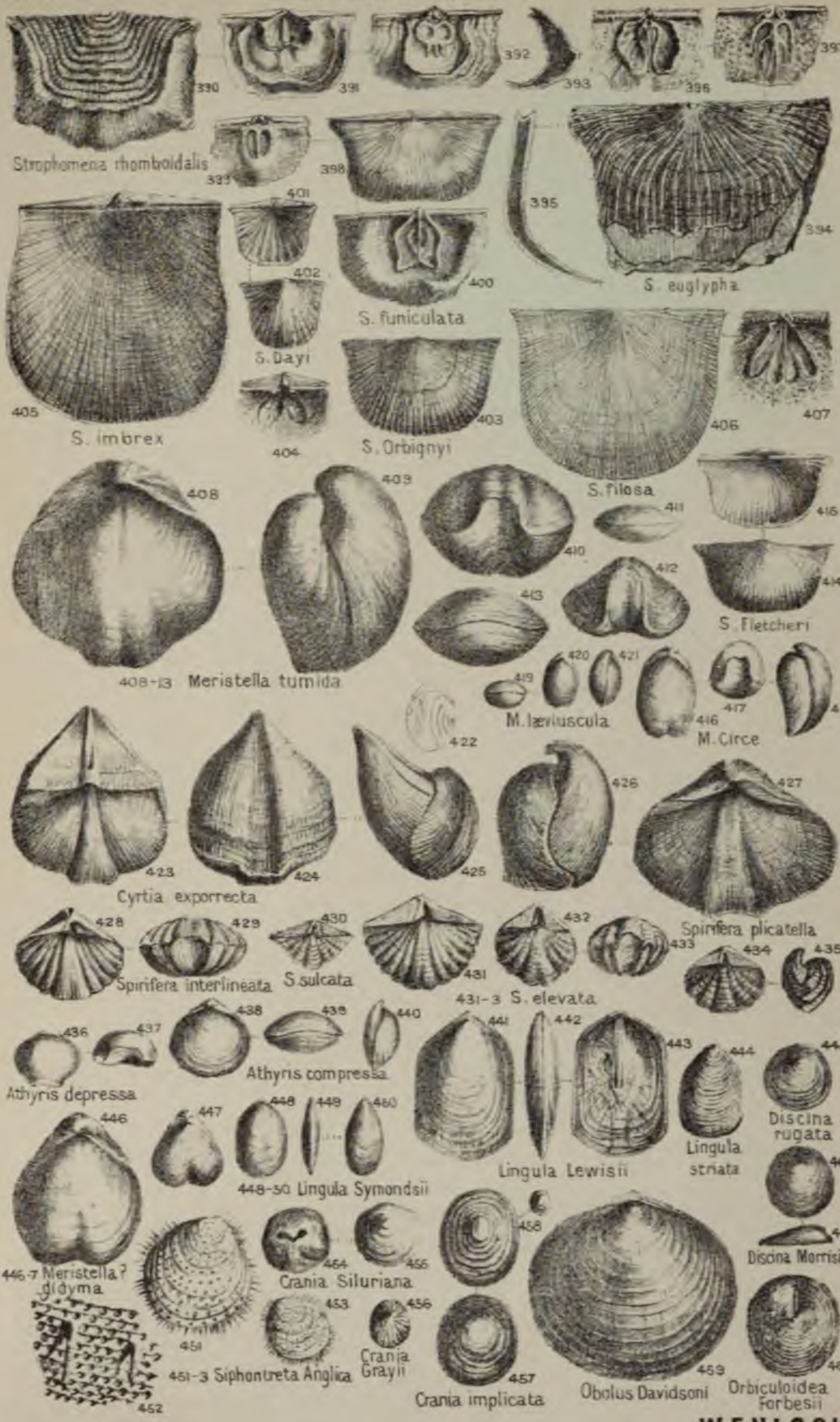
WENLOCK

[illegible]

J. D. la T. del.

PLATE XIII

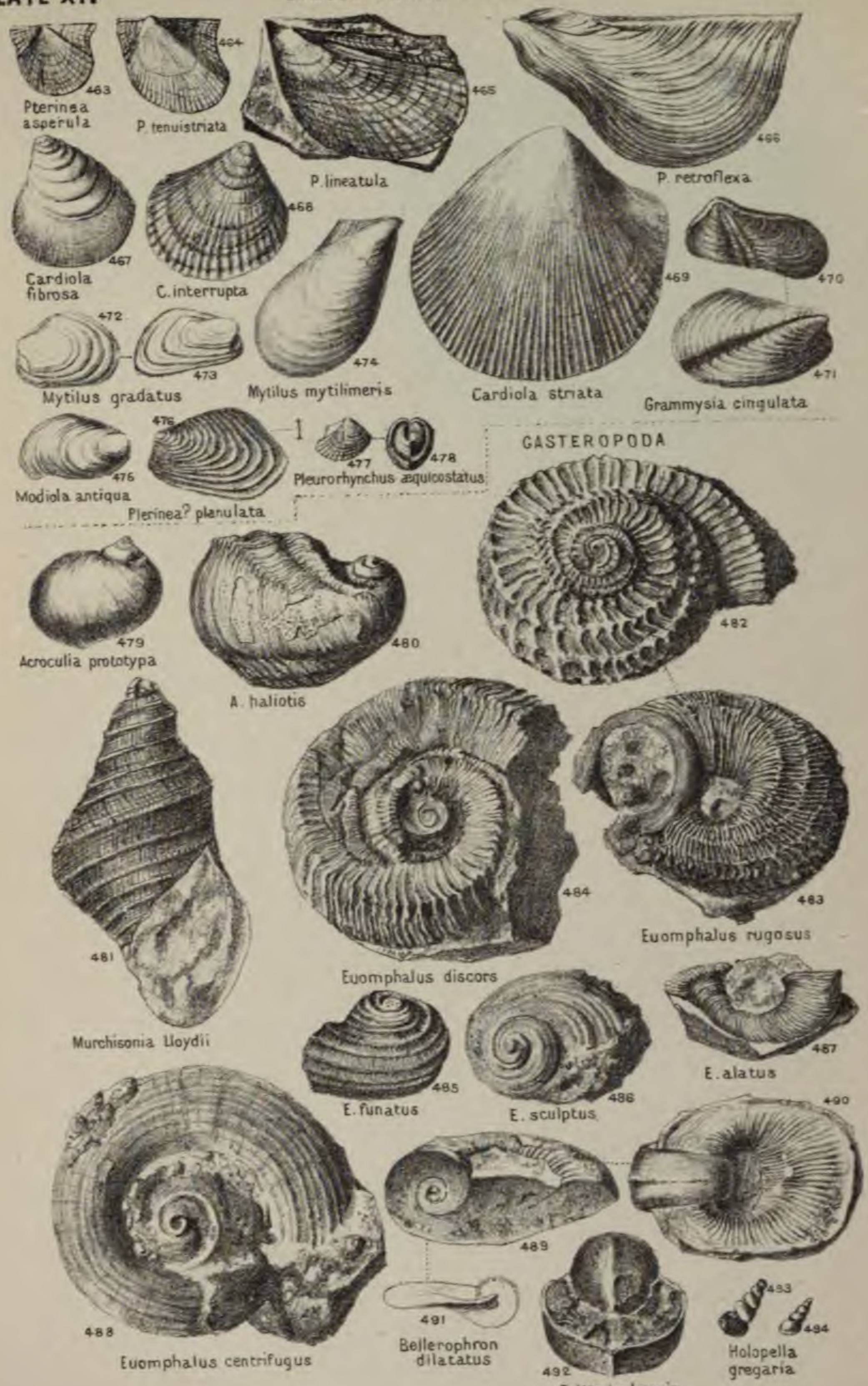
BRACHIOPODA



WENLOCK

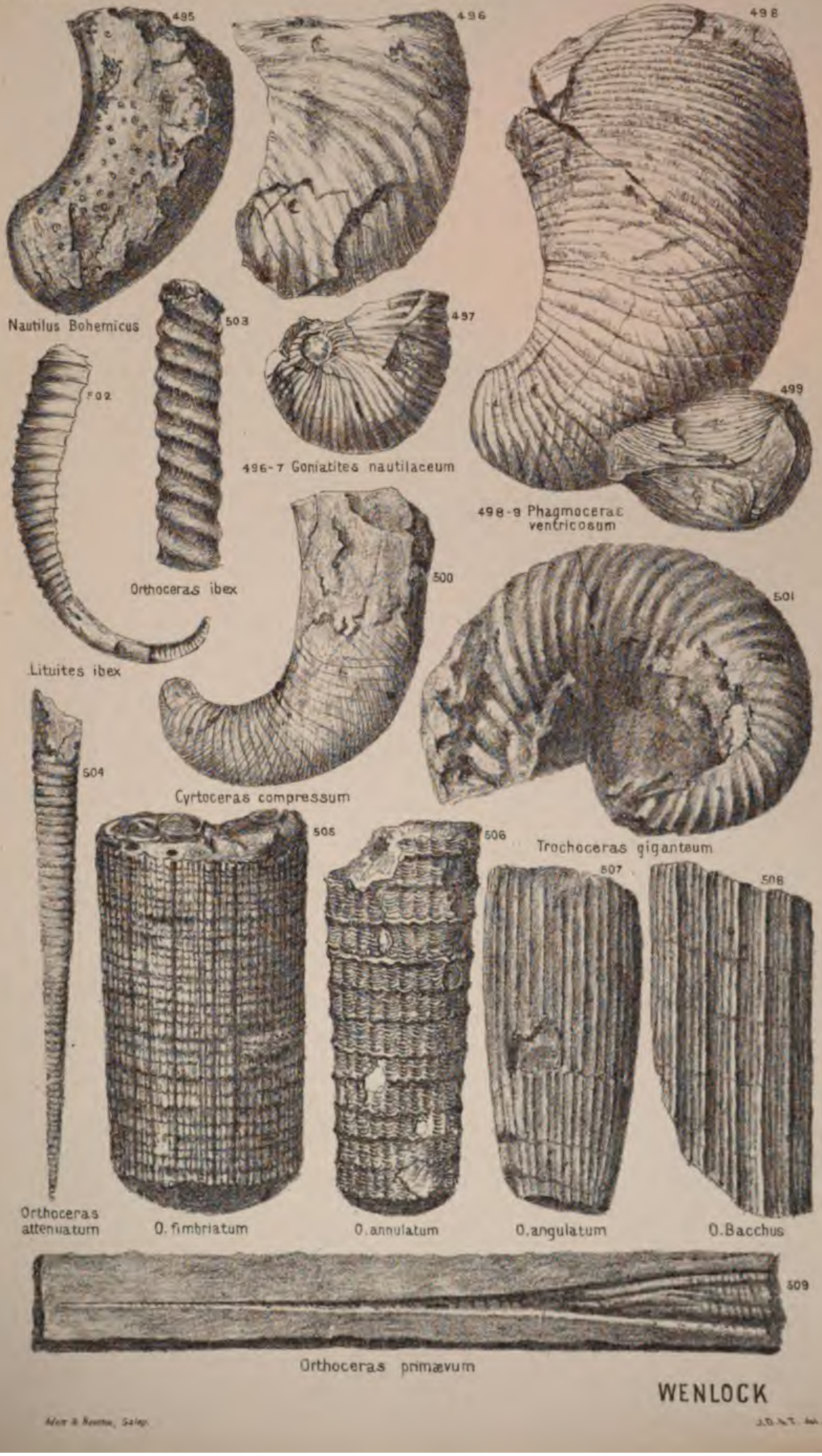
J.D. La T. del.

PLATE XIV



WENLOCK

PLATE XV CEPHALOPODA



WENLOCK

Adnitt & Naunton, Salop. J. D. & T. del.

PLATE XVI CEPHALOPODA

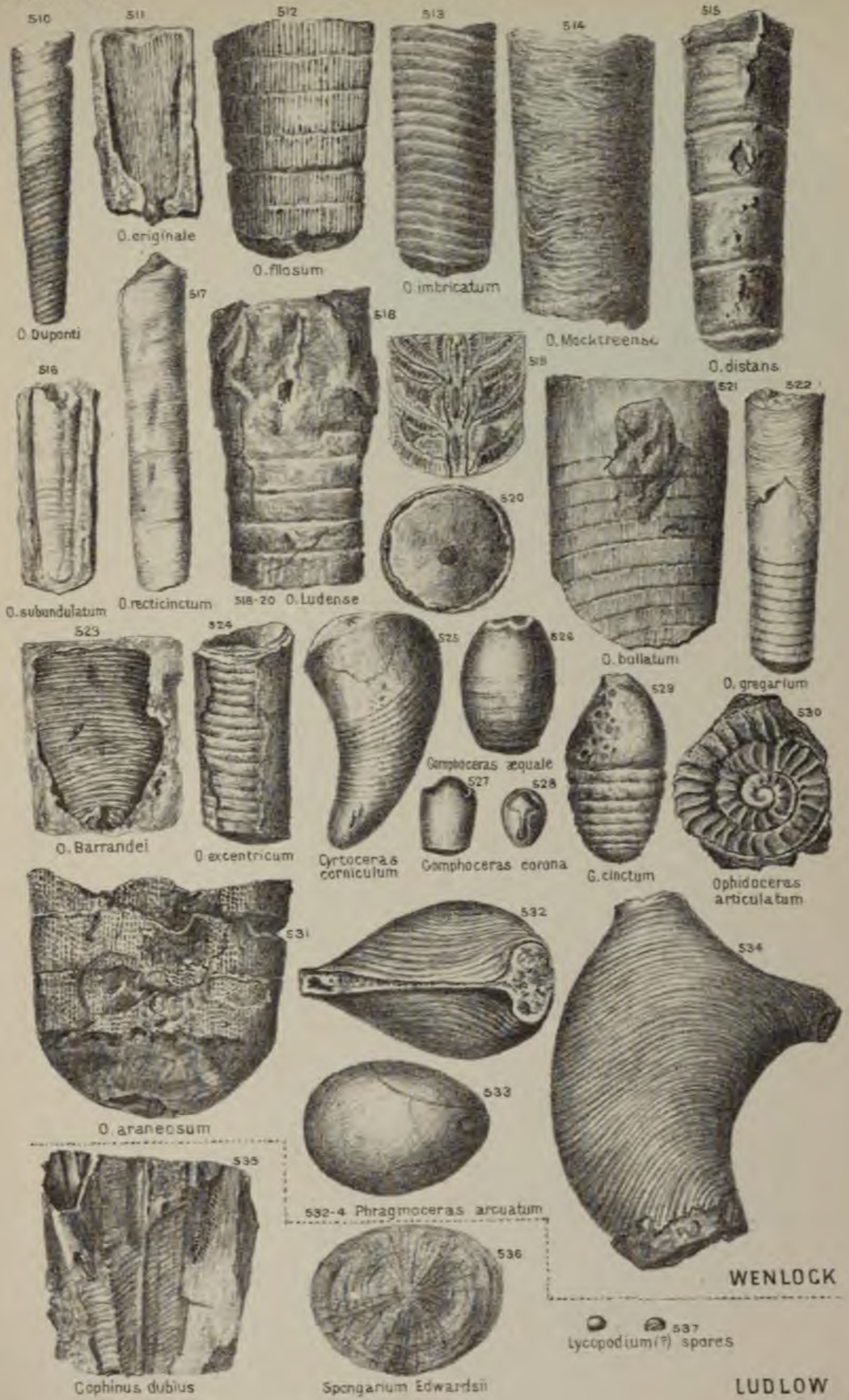
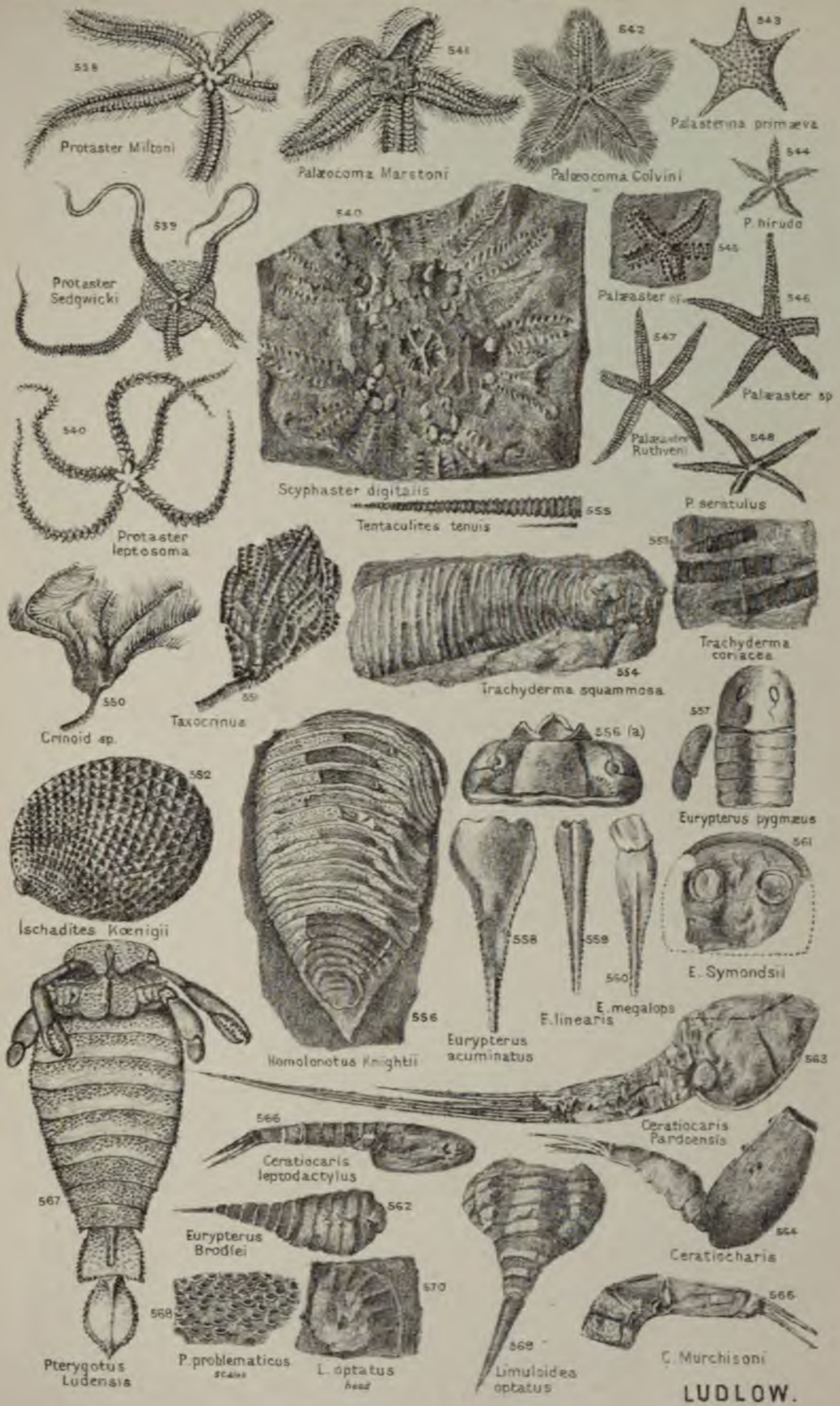


PLATE XVII.

ECHINODERMATA ANNELIDA CRUSTACEA.

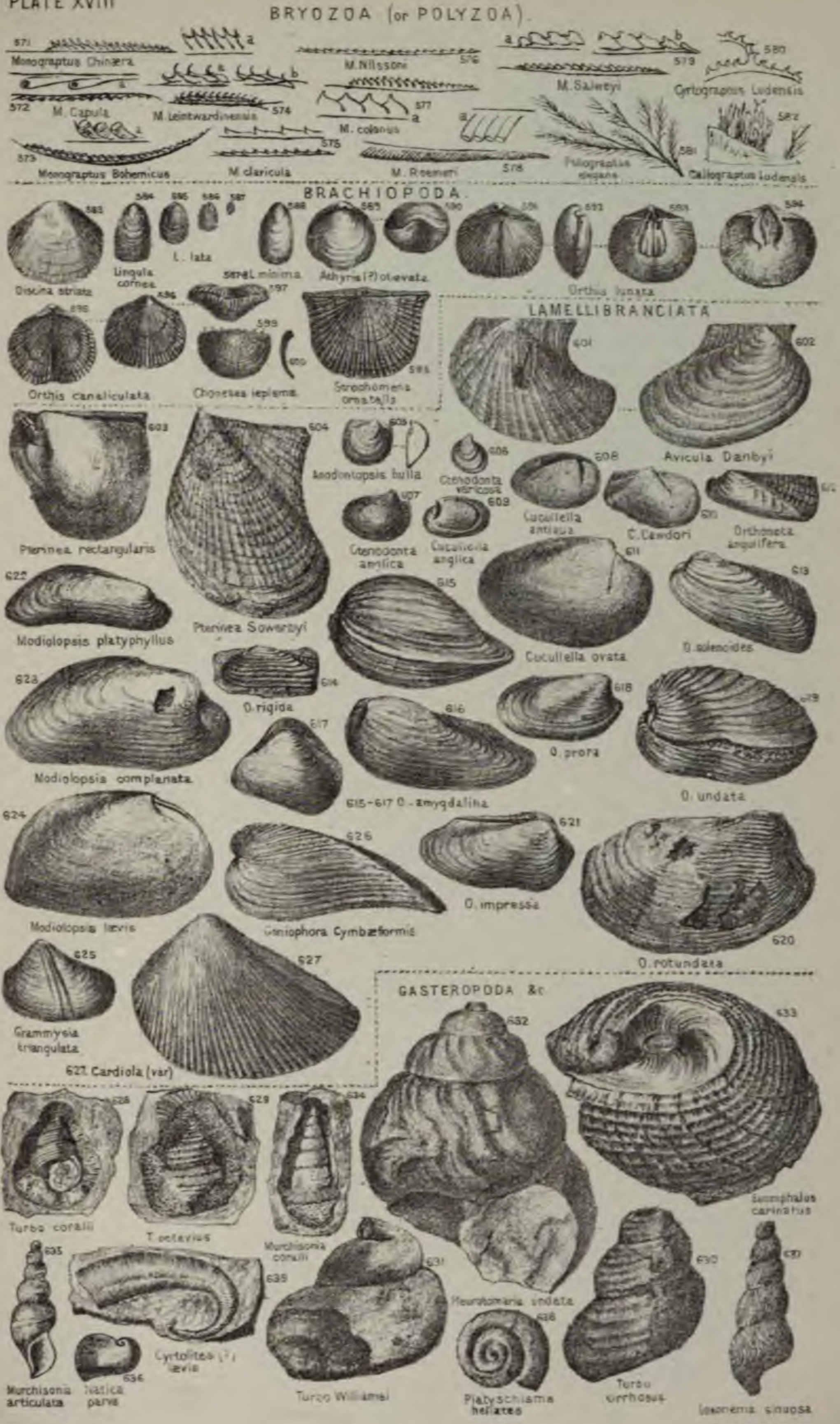


LUDLOW.

[illegible]

J. D. la T. del.

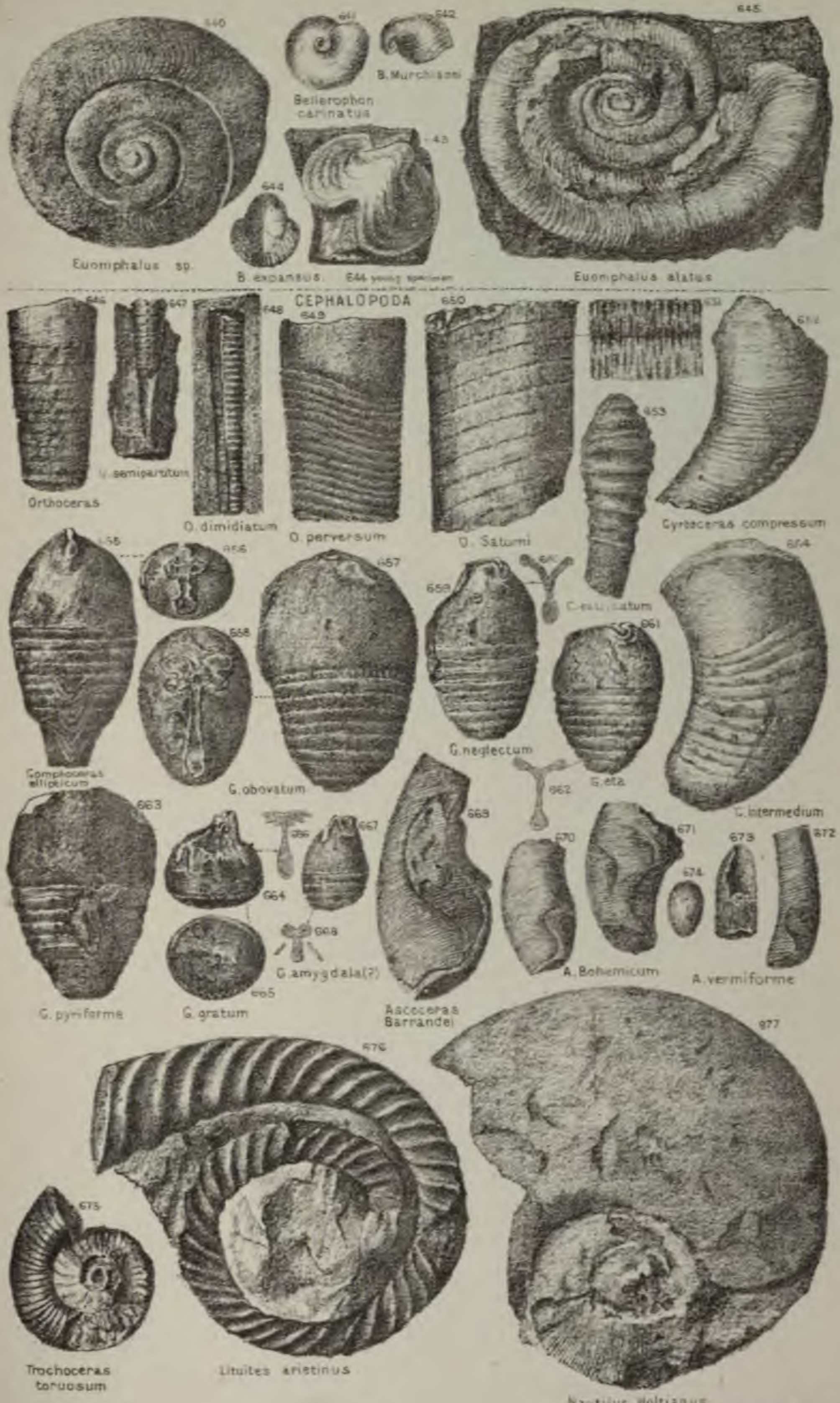
PLATE XVIII



LUDLOW.

PLATE XIX.

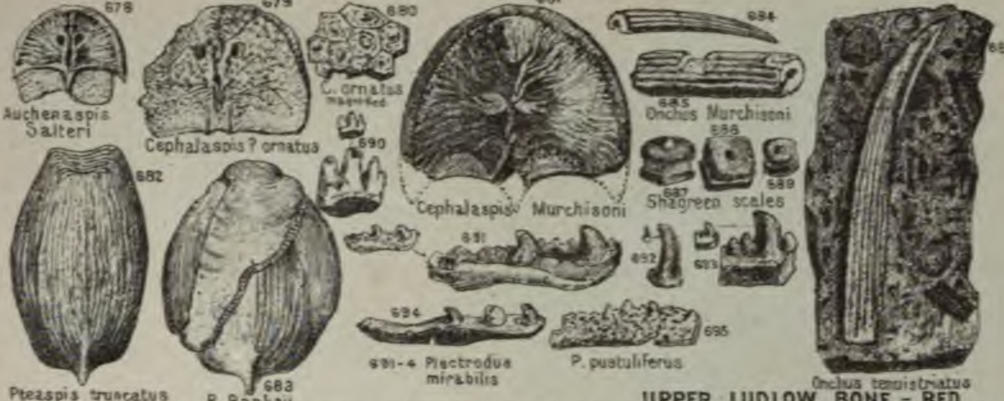
GASTEROPODA &c.



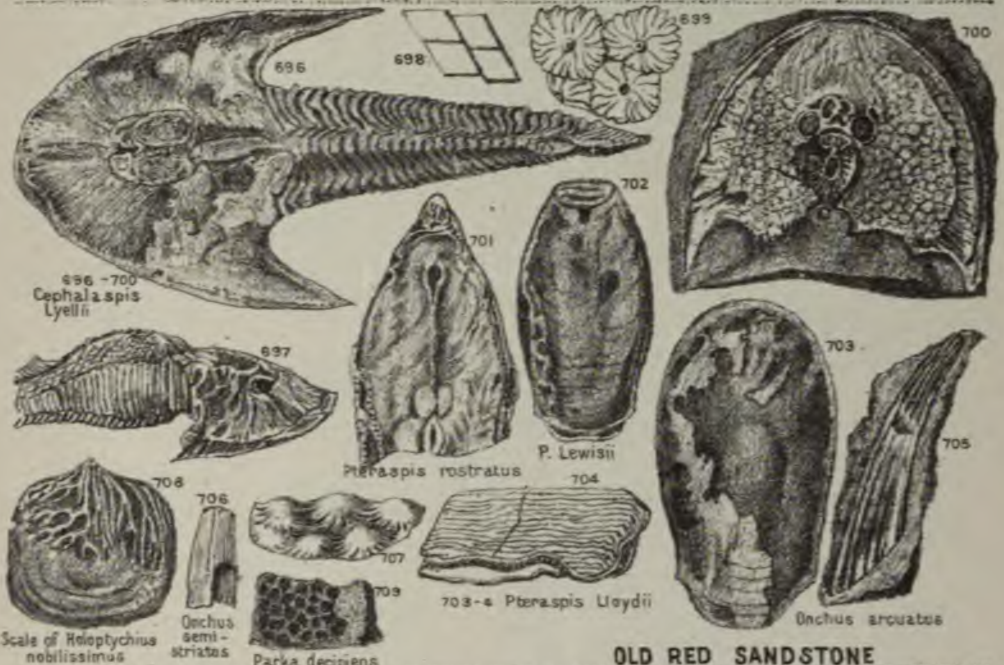
LUDLOW

PLATE XX

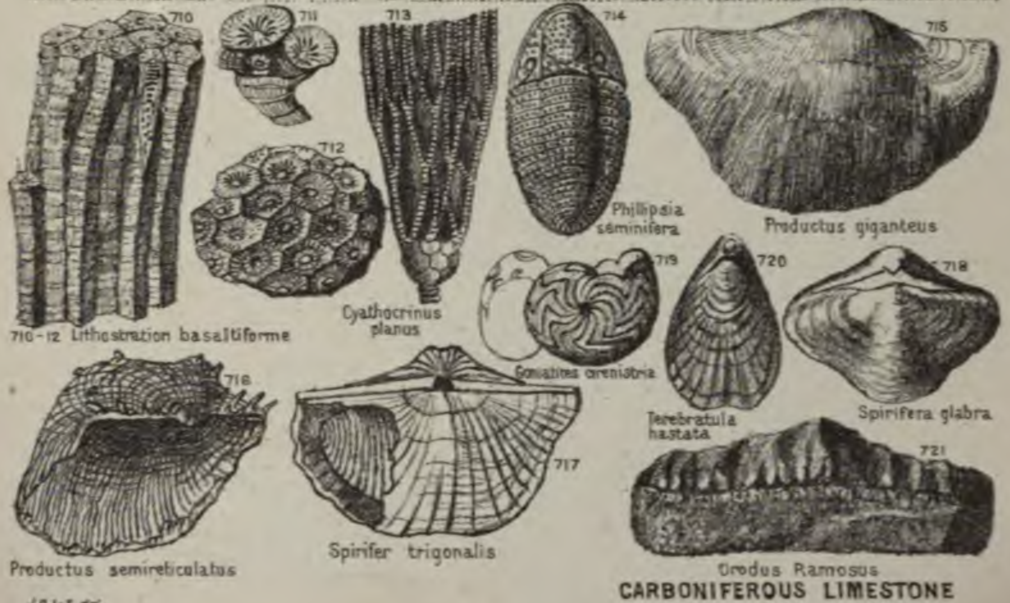
FISHES



UPPER LUDLOW BONE-BED



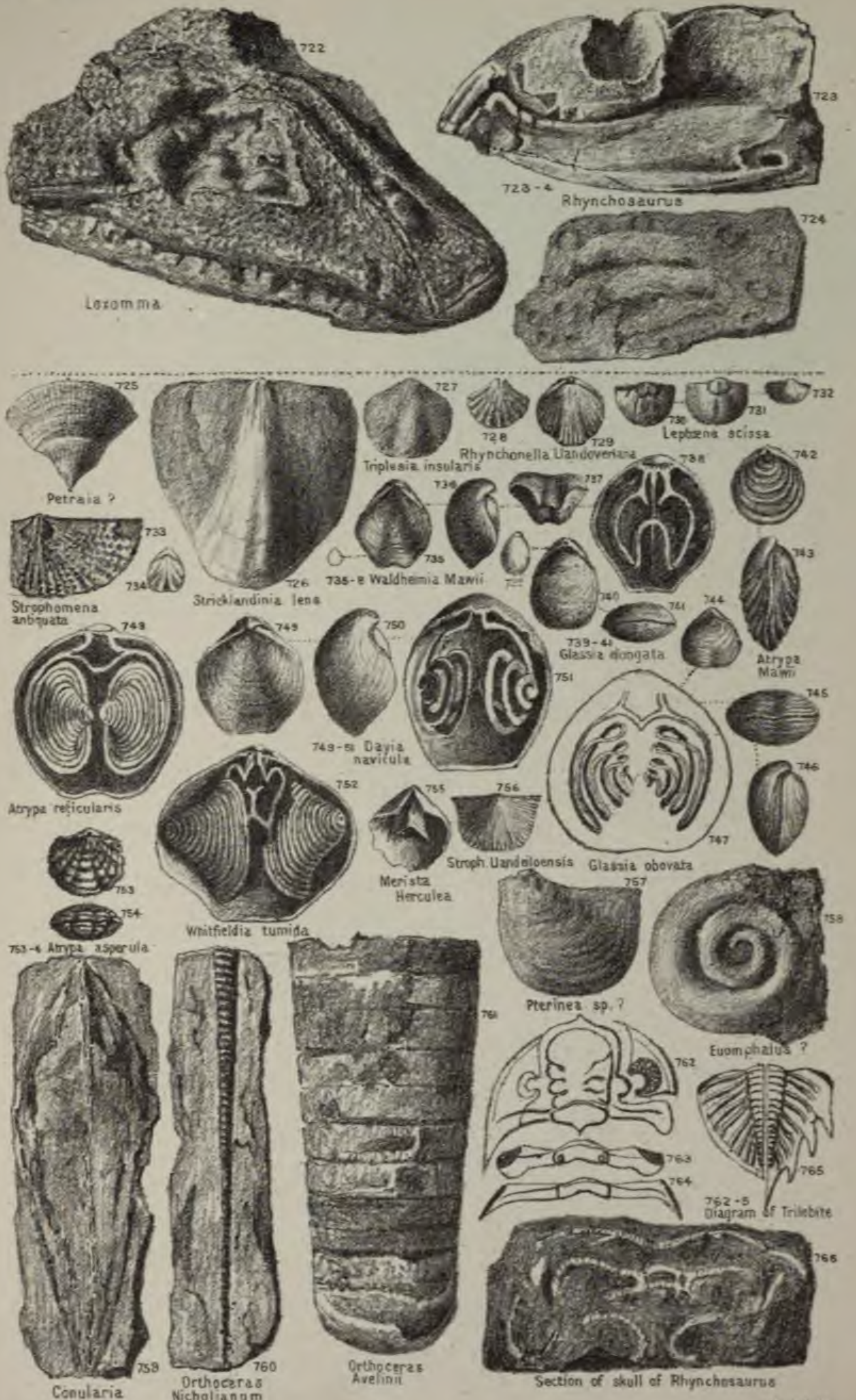
OLD RED SANDSTONE



CARBONIFEROUS LIMESTONE

J.D.La T, del.

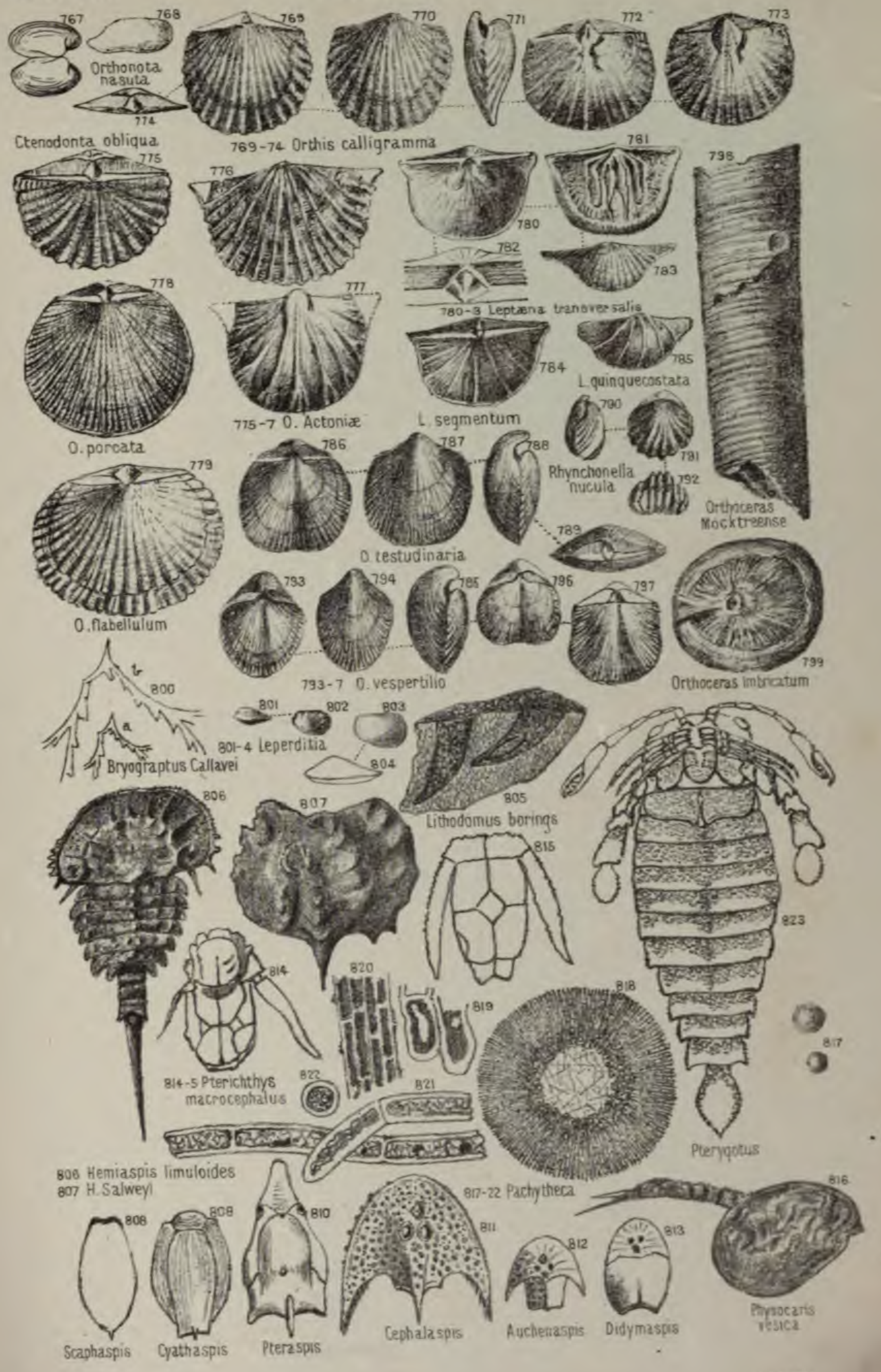
PLATE XXI.



J. D. La T. del.

ADNITT & NAUNTON, SALOP.

PLATE XXII. **MISCELLANEOUS.**



J. G. La T., del.